

The AMSAT[®] Journal

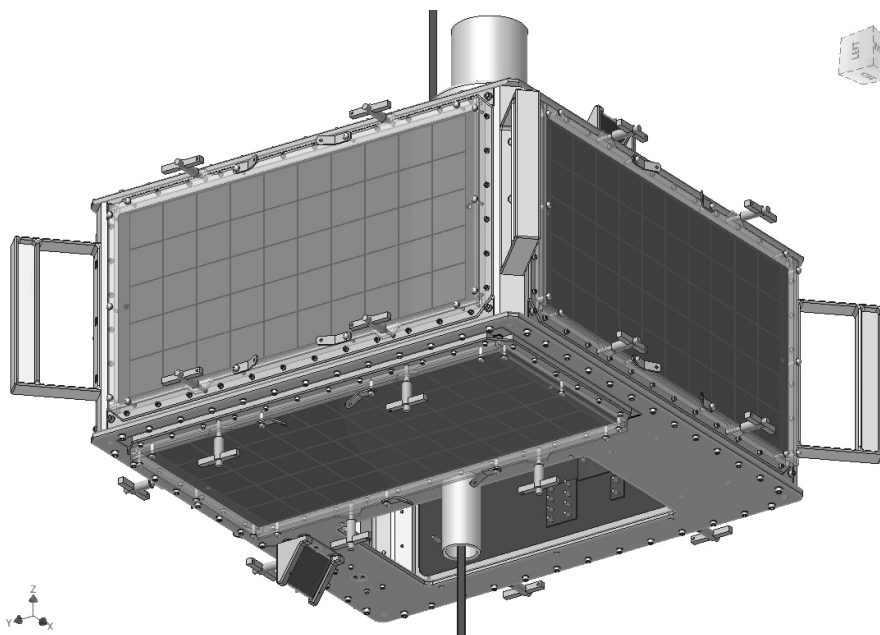


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Volume 33, Number 2

March/April 2010



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Pass me that microphone!

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AMSAT Announcements

Board of Directors Nominations

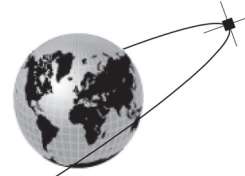
It is time to submit nominations for the upcoming open seats on the AMSAT-NA Board of Directors. A nomination requires either one Member Society or five current individual members to nominate an AMSAT member for the position. Three director's terms expire this year: Tom Clark, K3IO, Lou McFadin, W5DID and Gould Smith, WA4SXM. Nominations must be in writing and mailed to: AMSAT, 850 Sligo Ave #600, Silver Spring MD 20910. They must arrive no later than June 15th. 🌐

AMSAT's Mission

AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow Amateur Radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

AMSAT's Vision

Our Vision is to deploy satellite systems with the goal of providing wide-area and continuous coverage. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups.



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Since writing my last Apogee View column in February, there has been a continuing focus of activities that warrant updating to the membership. These include:

ARISSat-1

There are other articles in this issue that provide technical updates on the status of this project, so I won't repeat them here. I do want to highlight several items, however.

1. In March, as President of AMSAT, I signed a protocol with NASA and RSC-Energia committing to timely delivery of ARISSat-1 to Moscow no later than 1 July 2010. This delivery will consist of two 'units'—a satellite and a second unit (minus solar panels) to be used for crew training. The second unit will be identical to the first, but it is the flight unit that will undergo vibration testing in May in the US.

This commitment was made after a review of outstanding items gave us confidence that the project schedule is doable. While a significant amount of work remains, unless there are unexpected issues that come up, AMSAT is very confident that we will deliver flight hardware on time.

2. I signed a second protocol in late April with NASA and RSC-Energia concerning other aspects of the ARISSat-1 project that commit the parties towards meeting mutually agreed expectations. For example, NASA is handling the export licensing process for ARISSat-1. AMSAT is still responsible for the actual shipment, and we're working with a freight forwarder to make suitable arrangements for shipment to Russia. RSC-Energia has formally committed to providing the upmass on a Progress cargo vessel to the ISS this Fall and will deploy the satellite during an EVA.

3. The strategic importance of ARISSat-1 cannot be overstated. We expect ARISSat-1 to be the prototype for future opportunities to deploy satellites from the ISS. Combining both educational outreach and Amateur Radio equipment in one satellite is a model for gaining space agency support. Successful deployment and operation of ARISSat-1, including data gathering from the Kursk State Technical University experiment, will hopefully provide

future opportunities for deployment of follow-on satellites. Nowhere else has the Amateur Radio community been given such access to launch opportunities.

Stayed tuned for more updates on ARISSat-1. This is an exciting and wonderful opportunity for the Amateur Radio community.

AMSAT Fundraising

In April, the Dayton Amateur Radio Association (DARA) announced that they would match one-for-one any donations made to AMSAT in support of our satellite building activities. Their commitment maxes out at \$5,000.00 and AMSAT has until 1 Sept 2010 to solicit and collect donations that are candidates for this matching program.

DARA's support of AMSAT and our efforts to keep Amateur Radio in space is unprecedented for an Amateur Radio club. You will recall that AMSAT received a \$5,000.00 gift at the 2009 Dayton Hamvention from DARA. This year, DARA is also encouraging others to support our efforts by providing a generous incentive to gain broader support. Please remember that our membership dues do not provide funds for satellite projects. Consequently, it takes donations above and beyond our dues structure to provide the funds needed to keep Amateur Radio in space.

We are now including in our renewal forms and highlighting at hamfests the DARA matching gift challenge. Please help AMSAT to take full advantage of this opportunity by making your contribution NOW, including President's Club donations, to meet this matching gift challenge.

Project Fox

Our next project following ARISSat-1 will be a CubeSat. As I noted in my previous column, our engineering team's focus on ARISSat-1 has forced AMSAT to defer resources from Project Fox, particularly with regard to the engineering team leadership. Unfortunately, the longer development time for ARISSat-1 has impacted our ability to focus on the groundwork needed to get Project Fox started. Given that we must take

continued on page 22 ...

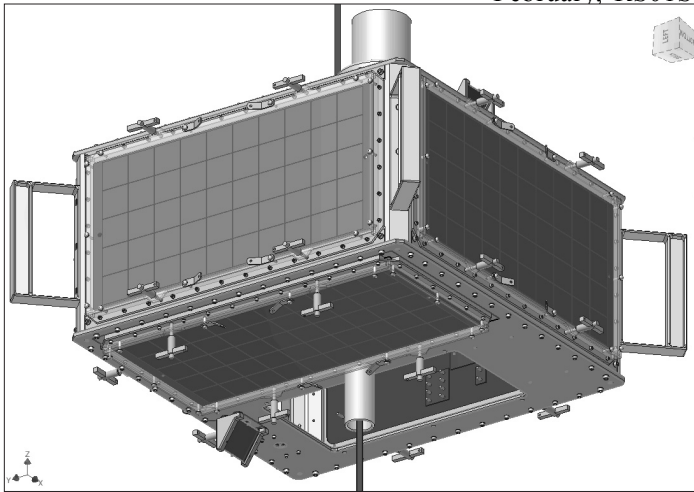


ARISSat-1 Status – April 2010

Gould Smith, WA4SXM, wa4sxm@amsat.org
AMSAT Project Manager for ARISSat



The ARISSat project continues to make progress toward having a flight and test unit in Russia July 1, 2010. AMSAT, NASA and Energia signed a protocol document in mid-March that said that the ARISSat team would deliver the satellites by the July 1 date. We will produce five units – one prototype and four flight and test units. The prototype will be used for demonstrations, while we will use the other units for this and future flight opportunities.



ARISSat-1 bottom view drawing by Bob Davis, KF4KSS.

A design review was held in mid-February, the presentations for the review can be found from the AMSAT Web site front page, top right link to ARISSat. I encourage everyone to go to the Web site and check out the fine work these dedicated team members have done in developing this satellite. Another review of the Safety Data packet was done in April before submitting it to the NASA Safety panel.

The satellite received a new call sign in February, RS01S. Future missions will use this format and increment the last digit.

Structure

Lou McFadin, W5DID and team have built the prototype and are currently completing the delivery units. Bob Davis, KF4KSS, and the structure design team have completed the design and mechanical drawings. Nearly all the metal work is complete. Bob has also prepared the

vibration test plan and test procedure.

Solar Panels

We have one set of NASA-supplied solar panels (plus a couple of spares), so we will only be able to build one complete flight unit. Each of the flight unit solar panels will have a clear Lexan cover panel that will be removed before deployment. If any of the cells are damaged before deployment, the cover will remain on the spacecraft for safety reasons. Lou and Bob Davis have designed the panel back plates and Lexan covers. The panels will be ready for flight next month. The initial bonding of the first solar panel to the aluminum back plate identified a difference in the thermal expansion rate between the solar panel and the backplate. Bob and Lou are now going to use Velcro to attach the solar panel backing to the plate. The Velcro will absorb the 1mm expansion difference.

Thermal

Dick Jansson, KD1K, with input from Bob Davis did multiple thermal analyses on the spacecraft and identified that the satellite will

be colder than previously expected. They have developed changes to make the system conserve heat. The top and bottom plates (+Z and -Z) are nickel plated. Most of the internal modules will be coated black and the interior of the space craft will be black anodized. This will be interesting to track with the telemetry.

Battery

The Kursk State Technical University has provided a new Silver-Zinc battery for the space craft. This battery is the same one as used in the Russian Orlan suits. We will be gathering new data on how this battery technology behaves with many shallow charge/discharge cycles over a long period of time. The battery will be operating in a less than optimal temperature range. So Bob, Dick, Energia and Kursk have specified a blanket for the battery to conserve heat. Excess power from the solar panels will be used to charge the battery.

Experiment

Kursk is also supplying an experiment to measure the vacuum of space as the satellite orbit decreases. Samples will be taken each day and transmitted to earth on the BPSK signal. Phil Karn, KA9Q, has developed a new 1kBPSK encoding technique that should allow us on the ground to receive error free data under weak and fading signal conditions. We will also have the Phase 3 400 bps BPSK transmissions available.

The Control Panel units are built and ready. These contain the switches that the astronauts will activate just before the satellite is deployed. There are also 10 LEDs on the Control Panel to assist the astronauts

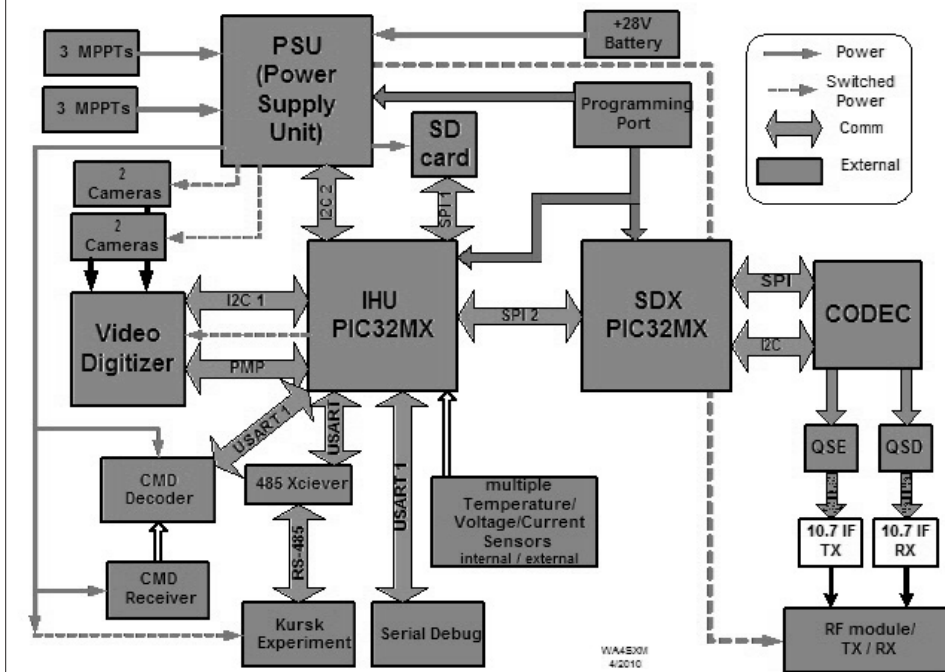


Barry Baines, WD4ASW, with the ARISSat prototype structure at the 2010 Orlando Hamcation.



Yardney Silver-Zinc batteries, used for development in place of the Russian Silver-Zinc battery.

ARISSat-1 IHU Module Diagram



Updated diagram of the ARISSat-1 IHU module and connections.

and ground based testing.

RF

Bill Ress, N6GHZ, has built a prototype and two flight ready units. The RF boxes contain the 2 m transmitter, 70 cm transponder receiver and a command receiver by John Klingelhoefter, WB4LNM, and Steve Bible, N7HPR. Additional RF modules are being built.

Software

Jerry Zdenek, N9YTK, has been the major coder the last year for the IHU, PSU and MPPT software. He has also been instrumental in setting up and maintaining

the software development process. We are using the open source SVN Subversion Repository for sharing files and doing parallel development. This has been working very well. Jerry also set up the open source Mantis bug tracking system for us to use in keeping track of software problems and their resolution. Tony Monteiro, Bill Reed and Jim Johns have worked on the SDX software, telemetry software, MPPT software and specifying the module interface software.

The IHU enclosure contains the main operating unit, consisting of the SDX

(Software Defined Transponder) board, the IHU (Integrated Housekeeping Unit – computer board), PSU (Power Supply Board), ICB (InterConnect Board) and the command decoder board.

All of the SDX boards are built and working. Steve Bible did the SDX board and Tony Monteiro, AA2TX, wrote the SDX software. The IHU boards are all built and working, but need some additional software written. Joe Julicher, N9WXU, and Jerry Zdenek, N9YTK, did the hardware design, layout and software for this board. Jerry did new board layouts in March and got them turned around quickly. The PSU boards are built and working, but also need a little software. The PSU boards were respun in March. The ICB board layout was changed to add a programming port, debug port and to improve the safety circuits. We have the new boards and are completing testing with them. The command decoder boards (Steve Bible) are working. Tony has been developing the power management software that will provide the maximum operational lifetime for the satellite. Since the battery was developed for the Russian space suits and a warmer operational environment, a number of compromises have had to be made to optimize the battery life.

The MPPT (Max Power Point Tracker) units are used to manage the power from the solar panels and charge the battery. They needed some work this year and boards had to be redone in March to better transfer heat. We have the new boards and are testing them. John Charais, Jerry Zdenek and Tony Monteiro worked on these boards and software. We now have the MPPT boards working with about 85% efficiency and much better heat transfer.

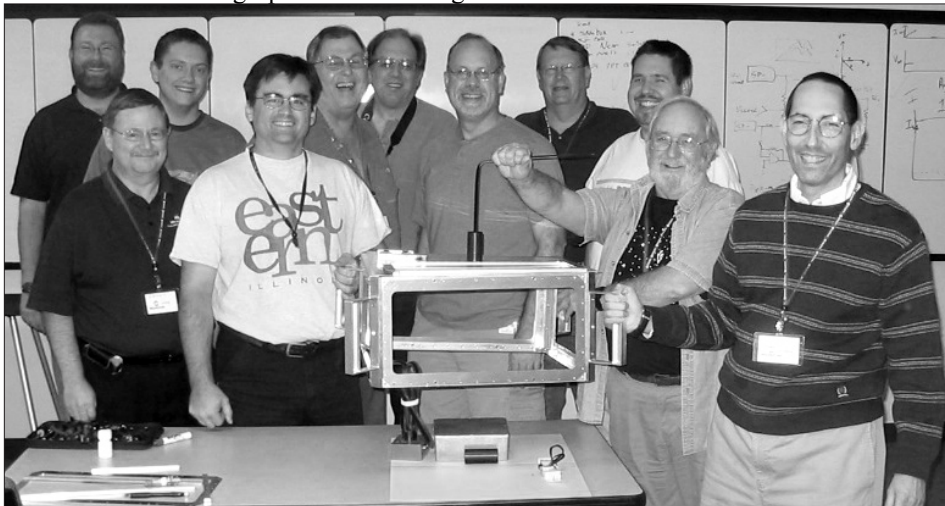
Larry Brown, W7LB, and Lou McFadin, W5DID, have designed the cables and Larry has made the cables for the satellites. We have a prototype and two sets of flight cables and Larry is working on completing the others. Larry has also produced cables for the thermal/vacuum chamber.

Lou McFadin has also designed and built the 2 m and 70 cm antennas for ARISSat.

Cameras have been tested down to -40°C for three hours and they worked fine. Bob Davis has designed a mirror system for the cameras to take pictures sideways from the top and bottom plate.

Flight Readiness

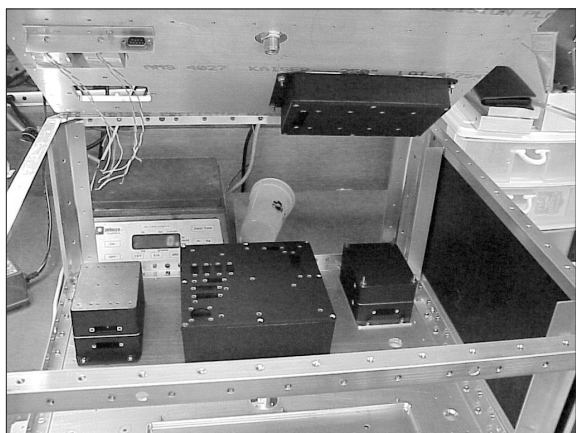
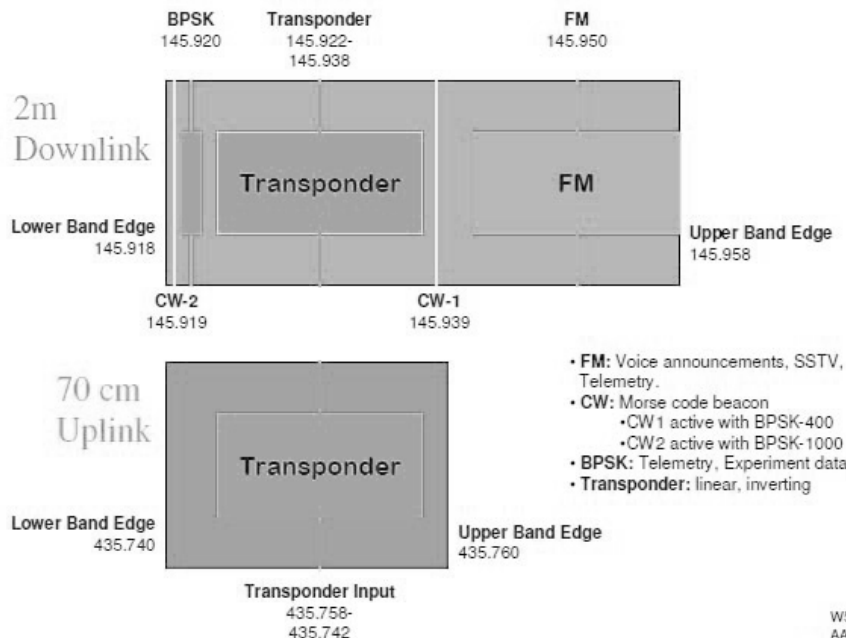
Chuck Green, N0ADI, has been building



Phoenix V ARISSat Meeting Team Picture: L to R, Bob Davis, KF4KSS; Jim Johns, KA0IQT; Tim Moffat; Joe Julicher, N9WXU; Larry Brown, W7LB; Phil Karn, KA9Q; Steve Bible, N7HPR; Bill Reed, NX5R; Jerry Zdenek, N9YTK; Lou McFadin, W5DID; Tony Monteiro, AA2TX. For this photo Gould Smith, WA4SXM, was behind the camera.



ARISSat-1 Band Plan



Test fitting the enclosures inside the ARISSat-1 structure.



Lou McFadin, W5DID, and Gould Smith, WA4SXM, testing the MPPT boards at sunset in Phoenix.

and/or examining all of the flight boards and been advising the team on how to produce a space-ready satellite. Tim Moffat, an intern at Microchip, has populated many, many boards over the last 2.5 years and been an invaluable asset to the team. We will be doing thermal/vacuum testing and vibration testing on the satellite.

All of the downlinks will be on 2 meters, but there will be four different modulations. The 2 m FM downlink we will have an English voice ID, recorded greetings from children around the world in 14 languages, spoken telemetry and SSTV images taken from the spacecraft. The CW downlink will be telemetry values and call signs of people instrumental in the ARISS program. The BPSK signal will contain telemetry and experiment data. There will be a 16 kHz wide U/V transponder.

There will be ground station software produced for the PC, Mac and Linux. Douglas Quagliana, KA2UPW, has working prototype software to demodulate the 1k BPSK signal and display the results. We anticipate having a complete software package that will use a computer soundcard to demodulate and display the BPSK data, the SSTV image and the CW.

We are revamping the AMSAT thermal/vacuum bell jar to test the modules. Lou McFadin, Bob Davis and Stan Wood are working on getting the chamber operational for testing the first week in May. Lou has developed a signal pass through box that will be useful for many years. We are using a new fluid for cooling that is much safer than the acetone that was used before. Large resistors are used for heating.

Bob Davis and Lou McFadin are developing shipping containers for the satellites out of used containers that were designed to ship 19" rack mount units.

The major items left to complete the satellites are:

Scheduling vibration testing

NASA Safety Review

Thermal/Vacuum chamber completion

Thermal/Vacuum testing

Some IHU software

Power management software

We anticipate the satellite will be launched on a Russian Progress vehicle later this year and deployed from the ISS at the end of the year. ☺

Amateur Satellite Presentation at Ham Radio University 2010

by Peter Portanova, WB2OQQ, wb2oqq@amsat.org

AMSAT NY Area Coordinator

Ham Radio University 2010 (HRU), in its eleventh year sponsored by the Great South Bay Amateur Radio Club, is a day of education to share ideas, experiences, knowledge and fellowship among Amateur

I was too wordy and my early morning audience would tune me out and give me that “intelligent stare” and learn nothing and from this point on would scream hysterically every time someone mentioned anything about satellites!

I then developed slides with two bullets at the most, but had pictures to illustrate a point. As an example, we know that it is important to hear activity on a satellite before you consider transmitting; I would just show a picture of an ear and talk about that subject; the ear piqued their curiosity, getting the audience involved and tuned in. It worked – no one left the room!

Of course giving out

prizes helped and I only had a few glassy stares from the 50+ standing room only crowd that attended.

I began my satellite presentation by asking the group to consider thinking outside their comfort zone and commit to receiving a pass from AO-51. With a show of hands of who has the “courage” to go into space I loaned the first three space cadets a Diamond SRH789 antenna for their HT. Their only requirement was that they report their results to me and their club at their next meeting. The results I have seen from my past club presentations have seen an increase in satellite operators and AMSAT supporters! I give them a few passes with a TCA of at least 40 degrees, they will hear a few enthusiastic

operators like K8YSE or WA4NVM and they will be hooked!

An hour later we did the AO-27 pass, in twenty degree temperatures and a wind chill. All hail the brave group that stood with me, that is Neil, KC2KY the chairman of HRU moving the Arrow antenna. The rest of the “warm chickens” stood inside and heard the contacts that we were making. I fought back the tears welling in my eyes for fear they would freeze.

I’m glad that I left my personal comfort zone to participate in HRU 2010, I’m looking forward to 2011, and other events. Who knows, I may replace the “teaching ears” with real words – well only if it’s an afternoon session. ☺



Pete, WB2OQQ, at the podium presenting his talk about satellites and AMSAT.

Radio operators. The keynote speaker was Steve Ford, WB8IMY, *QST* Editor. In addition, 25 Forums including new forums like an Antenna Modeling Workshop, Working Satellites with your HT, Basics of Communications Theory and a Young Ham Forum were presented. Over 400 people attended HRU!

I was asked by the founder of HRU Phil Lewis, N2MUN, to give a fifty-minute talk on amateur satellites. This year’s chairman was Neil Heft, KC2KY, who gets the blame for getting me interested in amateur satellites. Accepting is easy, putting together a presentation to encourage HF and VHF operators to try the satellites, on a subject that some amateurs have the perception that you need a degree in Physics, was the challenge. I wanted to give an overview, of the amateur satellites and just enough information to encourage hams to give receiving AO-51 a try, an easy task that even a twelve year old can do. OK, let’s put my ideas on PowerPoint™!

I had completed about three slides, filled with wonderful information about how to receive signals from a satellite moving thru space. I came back to the slides at 8 AM the next day put them on my big screen and started to get dizzy. I came to the conclusion that I was breaking the “laws of overview”.



Pete, WB2OQQ, (at the mike) with Neil, KC2KY, as the rotator working AO-27. All the observers are behind the door all nice and warm! Note the HRU banner.



A Beginners Attempt to Operate AO-51

by Walter Paluch, KA2CAQ, ka2caq@arrrl.net

This article was first published in *The COMPASS*, a monthly publication of the Great South Bay ARC.

The wonderful thing about Amateur Radio is that there are so many facets of the hobby to experiment with. This is one such attempt.

In January I attended the satellite communications forum at Ham Radio University (HRU). The forum was given by Pete, WA2OQQ, our clubs' own satellite guru. [See previous article - Ed.] Pete's presentation was interesting, informative and fun, so I decided to give satellite operation a try. This article is not about how to operate, but rather my experience as a novice satellite operator trying to work an Amateur Radio satellite. There is plenty of info available on the Internet (www.amsat.org) about the how-to aspect of this type of operation.

AO-51 appears to be the simplest of the amateur satellites to work because it requires a minimum amount of equipment, half of which most hams already have. You will need a 2 m/70 cm transceiver and a good satellite antenna. I already had my trusty Yaesu VX-5 and my VHF/UHF radio, but I did need an antenna. A very popular one is the 146/437-10WBP made by Arrow Antenna Co. This Yagi contains a built in duplexer in the boom to combine both antennas into a single cable for attaching to the HT. The antenna provides 6 dB of gain on the 2 m uplink and 10 dB on the 70 cm downlink. The antenna is very portable and breaks down so no part is longer than 22 inches (total assembled length is 37.5 in.). It is light weight at just 19 oz. The elements are actually made from aluminum arrows (as in bow and arrow) shafts. An orienteering compass is also handy to have, for those who are directionally challenged, along with an

accurate timepiece (i.e., a watch).

AO-51 passes over your QTH several times a day (its orbital period is about 100 minutes) with a passes lasting from 2 to 4 minutes to as long as 15 minutes. AO-51 is a low Earth orbiting (LEO) satellite orbiting at an altitude of 500 miles above the earth's surface.

The antenna arrived via UPS so I thought this moment was as good as any to give this a try. There was a good pass coming up with a maximum elevation of 37 degrees from the SE to the NW, perfect position from my backyard deck. Just at the predicted time, there it was. I started to hear call signs, faint at first but with each passing second stronger and stronger. I must say it is a bit tricky, juggling the antenna in one hand and the HT in the other. You must also adjust the receive frequency to compensate for the Doppler effect and also twist the antenna around to compensate for fading due to polarization changes of the satellite signal.

I listened for a minute and announced my call "KA2CAQ handheld" — nothing. I tried again — still no response. I continued to call for the duration of the pass, hearing many stations but no one called me back. Oh well, as least I heard AO-51. Better luck next time. I guess.

The following attempt was a day later. It was a high pass at almost 90 degrees. The airwaves crackled to life. There were many US stations calling in from the east coast and the Midwest. I dropped my callsign into the mix and someone comes back to me. "KA2CAQ this is K???? grid square ?????... What? I missed it! Then another calls W4V something? ... Who?? I responded to a total of five stations who called me. Each QSL'ed my info KA2CAQ FN30, but I never got a complete call sign from any one of them. Great, I had just worked my first QSO's on AO-51, but I don't know who they were. Well, on the positive side I was heard with my big 4.5 watt signal. The third time's a charm or so it is said.

There has got to be a better way. How can I write down all this information, hold the radio and track the satellite? So the next thing I did was to buy a digital voice recorder at Radio Shack for \$29. Because AO-51 contacts are short, I thought I could make the contacts and play back the portions I missed. Seemed like a good plan.

The next time I was available for a good pass it was a very cold windy afternoon. Leave it to me to start this satellite thing in the dead of winter. I'm sure this is much more pleasant in the warmer weather. This pass was much lower than my last try. I can hear AO-51 as it rises above the horizon. YV6BFE is calling. Wow! Did I hear that correctly? DX loud and clear. There are others calling. "KA2CAQ hand held" I call. The next thing I hear is "KA2CAQ from YV6BFE FJ78. How copy?" I say "QSL all in FN30. You're my first contact and DX. Thank you, 73." "Great signal from your handheld, 73." For almost the rest of the pass I was in a state of jubilation. When I did snap out of it, I called one more time and worked WO3T. The pass was over and I had officially done it! I have continued working AO-51 each time improving my operating skills and techniques. This satellite stuff is pretty cool. Why not try it for yourself? Operating AO-51 has definitely got me excited about yet another mode in this great hobby of ours. Don't become stuck in a ham radio rut. There are so many avenues to try in Amateur Radio. Don't be afraid to try something new. 📶



Walter, KA2CAQ, preparing, an HT and Arrow antenna - it's that simple!



Walter, KA2CAQ, making contacts! The videographer is John, W2HCB, President of GSBARC.

Report From Baltimore

AMSAT's 2009 Space Symposium

AMSAT Celebrates 40 Years

AMSAT says, "We're Returning to Space"

by JoAnne Maenpaa, K9JKM, k9jkm@amsat.org
and Gould Smith, WA4SXM, wa4sxm@amsat.org

Introduction

The 2009 AMSAT Space Symposium and 40th Birthday Celebration was held on Friday, October 9th through Sunday, October 11th at the Four Points Sheraton hotel at Baltimore-Washington Airport.

The full agenda for the week included:

- Presentation by the Engineering Task Force to the Board Members
- AMSAT Board of Director's Meeting (open to members)
- Exciting presentations of Amateur Radio in space
- AMSAT Annual Membership Meeting
- AMSAT 40th Birthday Party with Cake
- AMSAT Annual Banquet with Speaker and Door Prizes
- Field Operations Breakfast
- IARU Satellite Forum
- Poster Sessions
- ARISS Operations Team Meeting
- LCROSS Lunar Bash

Our thanks go out to the 2009 AMSAT Symposium team for a successful and enjoyable meeting: Frank Bauer, KA3HDO; Janet L. Bauer, Joseph Armbruster, KJ4JIO; Stephen Belter, N9IP; Bob Carpenter, W3OTC; Tom Clark, K3IO; Dick Daniels, W4PUJ; Arthur Feller, W4ART; Rick Hambly, W2GPS; Samudra Haque, N3RDX; Perry Klein, W3PK; Tim Lilley, N3TL; Eva Nahid; Martha Saragovitz; Dan Schultz, N8FGV; John Shew, N4QQ; Gould Smith, WA4SXM, Mark Steiner, K3MS, Dave Taylor, W8AAS

Engineering Task Force Report Charts Path to the Future

The Engineering Task Force was created in October 2008 to develop 'Next Steps' strategy for AMSAT to pursue going forward. The task force team members included:

- Bill Ress, N6GHZ (Team Leader)
- Drew Glasbrenner, KO4MA
- Tony Monteiro, AA2TX
- Tom Clark, K3IO
- Lou McFadin, W5DID

This team was initially tasked with developing recommendations regarding future satellite

projects in the light of the extreme launch cost expense associated with High Earth Orbit (HEO) satellites. Using K3IO's Eagle HEO/GEO Strawman proposal as a starting point the team developed a proposal to the AMSAT Board for a realistic and affordable way to get "AMSAT Back in Space."

Over the Past 12 Months, the Engineering Task Force:

- Evaluated launch opportunities
- Taken input on desired technology to be placed on spacecraft
- Reviewed various satellite-based options
- Examined the need for Program-based Management; establishment of engineering standards; established goals of creating interface specifications
- Develop 'modularization' strategy to adapt to various structures
- Provide engineering budget input for 2009

On Wednesday, the team presented its recommendation to the BoD based upon a number of considerations which included the cost to build/launch various satellite configurations along with development time and ability to meet short term launch opportunities. The recommendation included application of modular design that meets the needs of the amateur community. During the meeting, to clarify the recommendation, a table was developed that listed the various satellite types, cost to build, advantages and cost to launch. It was obvious that the proposed CubeSat recommendation was the best alternative. See Table 1.

Additionally the Engineering Task Force

recommended AMSAT establish realistic expectations and goals to operate in the challenging launch cost environment. Analysis of current costs showed that a 12 kg MicroSat, like AO-51, is no longer the low cost way into space. We must take advantage of the low cost CubeSat launch opportunities by supporting the ARISSat satellite program which forms the basis of funding the building and launch of an AMSAT 1U CubeSat as the next logical goal. This strategy is also expected to be leveraged into ride share opportunities that may appear in the future. This path will re-establish our credibility to build and launch a satellite, which we haven't done since AO-51 in 2004. It also opens a path to university cooperation programs which are discussed later.

With the election of Tony Monteiro, AA2TX, as the new VP-Engineering the short-term Engineering Task Force was disestablished with grateful thanks for their work over the past 12 months. Tony says his Engineering Department focus includes the completion of ARISSat-1, then begin planning and implementation of the AMSAT CubeSat project. A potential LEO Ride Share may materialize in late 2010 which would enable AMSAT to also orbit a U/V Repeater, U/V Linear Transponder, Camera, and possible SDX.

AMSAT Board of Directors Meeting

The board meeting was held on Thursday and Friday before the Symposium. The complete minutes of the meeting are included in this issue of the *Journal*. You are encouraged to read them to get a better picture of how the organization fared in 2009 and what goals were set for 2010.

Table 1: Satellite Build Criteria

	1 U CubeSat	3 U CubeSat	MicroSat Rideshare	MicroSat Basic	MicroSat Alternative
POWER	1 - 2W	3 W	3-5 W		5.5 W
Cost/Launch	\$70k	\$210K		\$350K	\$350K
Cost/Hardware	\$15K	\$30K	\$100K	\$10K	\$100K
Cost/Solar	\$3.6k	\$10K	\$10K	\$30K	\$45K
Features	simple	modest	basic	basic	interesting
Dev People	OK	tough	OK	tough	easy
Dev Time	1 year	2 years	1 year	2++ years	2+ years
	\$90K	\$250K	\$110K	\$400K	\$500K



AMSAT is Returning to Space

The Board of Directors has adopted the Engineering Task Force recommendation that low-cost launch options be immediately pursued. The AMSAT engineering team will develop a 1U CubeSat design effective immediately. Engineering Task Force team member Tony Monteiro, AA2TX, now Vice-President of Engineering said, "We are recommending an approach that gets AMSAT back up in space with new satellites by leveraging the skills and technology we have today."

The new AMSAT CubeSat's initial capability is planned to add to the popular low-earth orbit FM transponder fleet allowing hams to continue to use their existing dual-band handheld radios and portable antenna systems. This also allows an accessible entry path for new satellite operators to get started. The existing FM satellites are starting to show their age.

The flight version of ARISSat-1 has been developed to fit into the CubeSat model. AMSAT's flexible Software Defined Transponder (SDX), simplified IHU, power control subsystem, external interfaces to experimental payloads and cameras will now allow a modular approach to mission design using proven subsystems and components. The ARISSat-1 mission planned in 2010 will be the initial flight test of AMSAT's modular satellite. [See status article in this issue – Ed.]

Here are key highlights of the Engineering Task Force's recommendations ...

- AMSAT will develop comparable AO-51 level of performance packaged into a 1U CubeSat. This includes a U-V transponder, V telemetry, U command receiver, IHU, power control. This can be done with our modular design.
- This will be a U/V FM Transponder, not done before in a 1U CubeSat, which can be worked with a HT and a simple antenna. CubeSat power limitations are planned to be addressed through research and development of deployable solar-cells.
- AMSAT will make our open-design satellite modules and technology available for other satellite teams to build into their missions.
- This new approach will provide a reliable radio link for future CubeSats allowing university teams to concentrate on their scientific objectives.

- The modular nature of the AMSAT CubeSat system will allow add-on missions utilizing several different types of modulation and bandwidth. These can be pursued with future low-cost CubeSat launch opportunities.

Active satellite users, who were present at the Annual Meeting and those who attended via the EchoLink conference, offered their reactions to this announcement.

Patrick Stoddard, WD9EWK, said, "I like the overall plan. Building and launching the new satellite in the \$90K range is an achievable goal and one that will be a new and interesting challenge. With the plans to build components that can be available for future satellites, we will have an opportunity to build satellites quickly, in case launch - or rideshare - opportunities that AMSAT can take advantage of appear in the future. More satellites that we can use are a good thing - no matter if the satellites are at LEO, MEO, or GEO."

John Papay, K8YSE, added, "I listened to the Echolink audio of the general meeting and found it to be very informative. AMSAT needs to stay involved in the satellite business and the board has come up with a strategy to do that with the resources we have or that are within reach financially. I am in agreement with this concept. Build and launch what you can do from a technical and financial perspective. We need use the birds we have to their fullest extent possible and design, build and implement what you can financially afford while keeping a HEO/MEO/LEO package that can be ready to go if the opportunity arises. It's a plan that I can support."

Educational Outreach

New AMSAT Satellite Laboratory Proposed at University of Florida

AMSAT President, Barry Baines, WD4ASW, discussed an opportunity under serious discussion with the University of Florida, Gainesville to locate AMSAT's satellite laboratory on campus.

Among discussions over the past 12 months, AMSAT has had conversations with several universities concerning a potential relationship. This opportunity arose out of an Amateur Radio talk given at The Villages ARC by David Jordan, AA4KN, and Drew Glasbrenner, KO4MA, in April. This led to contact with Dr. Norman Fitz-Coy at the University of Florida. A Memorandum of Understanding has been drafted and

is currently under review by legal teams. At this time there is no timeframe for bringing about a formal conclusion as the MOU discussions continue and internal UF approval still needed.

Relocating the AMSAT Lab from the 'Eastern Shore' to 'The Swamp' offers significant potential:

- Location on a major university campus in a state-of-the-art building
- Integrated into a facility focused on small satellite development with clean room installation at the host's expense (not AMSAT)
- Potential for student projects focused on AMSAT needs
- Broadening of AMSAT's presence in the wider university community
- Potential research/development opportunities for AMSAT and AMSAT members
- Establishing a program that offers significant traction for education outreach

NextGen Development Program Announced

AMSAT will work with a university student engineering team to develop the NextGen Cubesat.

NextGen Program Manager, Alex Harvilchuck, N3NP, introduced this new program at the AMSAT Symposium. Alex revealed program goals and its initial plans with a paper in the *Proceedings* and presentations to the AMSAT Board of Directors and to the attendees during Symposium sessions.

NextGen consists of AMSAT volunteer mentors working with IBM Global Services Systems Engineering Division, and SUNY-Binghamton (also called University of Binghamton) senior level engineering students participating in their 'capstone' engineering project.

Alex summarized the NexGen program goals:

- Initial analysis of ARISSat-1, documenting the systems, and analysis of the lessons learned from ARISSat-1 and other prior spacecraft to create a building block architecture for future satellites.
- Open, modular, evolutionary, and documented design based on this analysis.



- Redesigning the ARISSat-1 Power Systems into a next generation power system using supercapacitors instead of batteries and reducing the footprint of some of the boards.
- Analysis and modification to the structure to incorporate deployable solar panels with a scalable design that will work for 1U, 2U and 3U sizes.
- Design a Picosat-class bus structure that AMSAT, or any other university, can use for 1U, 2U, or 3U CubeSat spacecraft. AMSAT could make the open design available at low-to-no-cost to qualified university groups.
- An Engineering Model of the NextGen CubeSat spacecraft bus will be on display at the Dayton Hamvention AMSAT Booth for everyone to study.

Alex summarized, "Starting with our initial core team of 34 students, plus advisers, mentors and volunteers at Binghamton University this will be an ongoing effort. It is not a one time event, but the start of a stable,

evolutionary design process that will further STEM (Science, Technology, Engineering & Mathematics) with the Next Generation of engineers and Amateur Radio operators. We are looking for other individuals and University/School teams to participate in all aspects of the spacecraft design – RF Systems - Guidance, Navigation, Control & Experiment Systems - Power & Structure Systems."

Volunteer mentors are needed! Even if you only have an hour a week, you can mentor a student over the phone or you can peer review a document that the students are working on. If you have more than an hour a week, you can implement a small design change to an existing subsystem; you could respin the board layout to meet a reduced form factor; you could redesign a module to use different technology. Contact Alex Harvilchuck via e-mail at amsat@elkmtn.org.

AMSAT's Board of Directors has approved the support of the University of Binghamton

NextGen CubeSat proposal and agreed to provide \$1,200.00 in immediate funding to the Binghamton Foundation to support student expenses and initially budgeted \$10,000.00 to cover material costs associated with hardware development between September 2009 and May 2010. The Board will review progress at the end of the first semester.

LCROSS Lunar Bash

Samudra Haque, N3RDX, hosted a session on Friday morning starting at 0600, "Let's Kick Up Some Moon Dust !" so that early attendees at the Symposium could watch the NASA televised coverage as the Lunar Crater Observation and Sensing Satellite (LCROSS) impacted into the Cabeus crater on the Lunar surface. This event also showcased NASA documentaries on the Lunar Reconnaissance Orbiter (LRO) and LCROSS missions, the Music Video "Water on the Moon" by NASA Deputy Project Manager John Marmie and then shifted to the live video in time for the impact.

Lordy, Lordy ... AMSAT Turned 40

AMSAT's 40th birthday was celebrated this weekend. Friday evening included a birthday party with a birthday cake for all AMSAT members attending the Symposium.

Symposium attendees also received a birthday present in their package of meeting materials. The book, AMSAT – The First Forty Years, compiled by Bill Tynan, W3XO, was given to all present. This history covers AMSAT's beginnings in 1969 through 2009. Contributions to the book were written by AMSAT members who have participated in our history including Keith Baker, KB1SF/VA3KSF; Dick Daniels, W4PUJ; Bob Bruninga, WB4APR, Lou McFadin, W5DID, and Ray Soifer, W2RS.

Presentations

See Table 2 at left.

Poster Sessions

Mark Steiner, K3MS, managed the poster session in the Scott Room. In celebration of the 40th Anniversary of AMSAT, the center of the room had displays of AMSAT related magazine covers over the years. Also on display were AMSAT publications, photographs, AO-7 satellite model, AMSAT pins and patches. SpaceQuest displayed a full scale microsat prototype. There was a nice ARISS display with prototype hardware that has been installed on the ISS. Our old friend Joe Lynch of CQ VHF magazine was there talking with friends and offering

Table 2: Authors and Papers Presented at the 2009 Symposium	
Author	Paper
Greg Jurens, WD0ACD	Using a Software Defined Radio with Integrated VHF/UHF for Satellite Operations
Andrew Glasbrenner, KO4MA	Lessons Learned at LEO
Dr. Julie Thienel and Bob Bruninga, WB4APR	PSAT, A Low-cost Data Communications Satellite With Sun Pointing Attitude Control
JoAnne Maenpaa, K9JKM	AMSAT Eagle Geostationary Platform Educational Opportunities
David Jordan, AA4KN	High Altitude Balloon Launch from the Astronaut Memorial Foundation Center
Samudra Haque, N3RDX	The potential of adapting AMSAT-NA Activities into lesson plans for U.S. K-12 Education
Alex Harvilchuck, N3NP	AMSAT NextGen Satellite Project
Tom Clark, K3IO	AMSAT: We ARE Rocket Scientists
Gould Smith, WA4SXM	The Transformation of SuitSat-2 into ARISSat-1
Robert Davis, KF4KSS	Mechanical design of ARISSat-1
Anthony Monteiro, AA2TX	Software Radio Technology on ARISSat-1
Bill Ress, N6GHZ	A Linear U/V Transponder for ARISSat-1
Jim Heck, G3WGM	FUNcube - AMSAT-UK's first satellite
Daniel Schultz, N8FGV	Hall Effect Thrusters for Amsat Satellite Missions, a Report from the International Electric Propulsion Conference
Hans van de Groenendaal, ZS6AKV	SumbandilaSat
Keith Pugh, W5IU	Amateur Radio on the ISS
Frank Bauer, KA3HDO	Amateur Radio Operations on Shuttle, Mir and ISS: Lessons Learned
Gould Smith, WA4SXM	AO-51 Status Year Five
Bill Ress, N6GHZ	KIWISat Update
Keith Lofstrom	SERVER SKY Computation in Orbit
James A. DeYoung, N8OQ	AO-7's Solar Array Power After 35 Years In Orbit
Martin Davidoff, K2UBC	Mayan Observations of Venus
Hans van de Groenendaal, ZS6AKV	Radio Amateurs should get more involved in educational satellites
Bob Twiggs, KE6QMD	Cubesats



magazine subscriptions. The ARISSast team had a mock up of the structure and working electronics. There was also a ground station capturing the signals, broadcasting the FM and CW audio, displaying live SSTV images and demodulating and display the BPSK telemetry signals. Bob Bruninga displayed some of the space hardware developed at the Naval Academy. The ANDE team was represented by Ivan Galysh and Jim McGuire with prototypes of their Castor and Pollux satellites. Douglas Quagliana, KA2UPW, had his Willow/Sabins AO-51 demodulation and display software running on a laptop. Greg Jurrens of FlexRadio was there demonstrating the radio and answering questions.

Awards

See Table 3 at right and as follows:

ARISSat Team Award

In recognition of your continued service to AMSAT in preparing the ARISSat-1 satellite for flight we thank: Steve Bible, N7HPR; Ken Blake; Larry Brown, W7LB; John Charais; Bob Davis, KF4KSS; Joe Fitzgerald, KM1P; Jim Johns, KA0IQT; Dave Jordan, AA4KN; Joe Julicher, N9WXU; Phil Karn, KA9Q; John Kingelhoefter, WB4LNM; Chuck Green, N0ADI; Lou McFadin, W5DID; Tim Moffat; Tony Monteiro, AA2TX; Stephen Porter, KE7URR; Douglas Quagliana, KA2UPW; Bill Reed, NX5R; Bill Riss, N6GHZ; Bob Schwerdlin, WG9L; Gould Smith, WA4SXM; Stan Wood, WA4NFY; Jerry Zdenek, N9YTK.

Engineering Task Force Awards

In recognition of your outstanding support to the Engineering Task Force we thank Tom Clark, K3IO; Drew Glasbrenner, KO4MA; Lou McFadin, W5DID; Tony Monteiro, AA2TX, and Bill Riss, N6GHZ.

Symposium Volunteer Awards

In recognition of your outstanding support to the 2009 AMSAT Symposium we thank Janet L. Bauer, Joseph Armbruster, KJ4JIO; Stephen Belter, N9IP; Bob Carpenter, W3OTC; Tom Clark, K3IO; Dick Daniels, W4PUJ; Arthur Feller, W4ART; Rick Hambly, W2GPS; Samudra Haque, N3RDX; Perry Klein, W3PK; Tim Lilley, N3TL; Eva Nahid; Martha Saragovitz; Dan Schultz, N8FGV; John Shew, N4QQ; Gould Smith, WA4SXM, Mark Steiner, K3MS, Dave Taylor, W8AAS.

Banquet

Our AMSAT 40th Anniversary Banquet Speaker was Dr. Martin Collins, a curator

Table 3: AMSAT volunteers were recognized for their contribution to the Amateur Satellite program	
The AMSAT Community Congratulates Our Award Recipients and Thank All Who Volunteer Their Time and Talent to Support the Ideals of Amateur Radio in Space	
President's Awards	
Gould Smith, WA4SXM	Outstanding leadership in the development of ARISSat-1, providing a significant difference in the management of this project.
Bob Felt, KB5YZG	Representation of AMSAT at the 2009 Shelby Hamfest, conducting satellite demonstrations and establishing an AMSAT presence in western North Carolina. You set an excellent example as a 'new blood' volunteer and serve as an effective area coordinator.
Gunter Meisse, W8GSM	Significant counsel and leadership as a member of the AMSAT Board of Directors 2003-2009, your superb financial work as Treasurer, and your leadership in improving AMSAT's information technology.
Bill Tynan, W3XO	Publishing an outstanding historical record of AMSAT's First 40 Years in time for our anniversary celebration.
Frank Bauer, KA3HDO	Your leadership of ARISS and your co-leadership of the 2009 AMSAT Symposium, resulting in a well organized, successful Symposium weekend.
User Services Awards	
Lee McLamb, KU4OS	Your continued service to AMSAT in producing the weekly AMSAT News Service and identifying launch opportunities.
Dave Jordan, AA4KN	Your continued service representing AMSAT at hamfests around the area.
Eric Christensen, KF40TN	Your continued service to AMSAT in managing the responses to questions that come into the AMSAT Web site.
Mike Young, WB8CXO	Your continued service to AMSAT in producing the popular LVB Tracker Boxes.
Stephen Belter, N9IP	Your continued service to AMSAT at Dayton, producing videos and volunteering to help AMSAT in so many ways.
Rick Hambly, W2GPS	Your continued service to AMSAT in keeping the AMSAT web site operational and providing invaluable support.
Patrick Stoddard, WD9EWK	Your continued service to AMSAT in representing AMSAT at many hamfests and gatherings, as well as being a great ambassador for the organization.
Tim Lilley, N3TL	Your continued service to AMSAT in working on the AMSAT Journal and promoting the organization on the air.
Alan Biddle, WA4SCA	Your continued service to AMSAT at Dayton and being an integral part of the Dayton Team.
Chuck Pinkham, K3PER	Your continued service to AMSAT at Dayton and being an integral part of the Dayton Team.
Gerd Schrick, WB8IFM	Your continued service to AMSAT by representing the organization at numerous hamfests throughout the years.
Roger Ley, WA9PZL	Your continued service to AMSAT at Dayton and promoting AMSAT at numerous hamfests.
Steve Coy, K8UD	Your continued service to AMSAT by representing the organization at numerous hamfests throughout the years.
Ray Hoad, WA5QGD	Your continued service to AMSAT in updating the weekly Keplerian elements on the AMSAT web site.
Steve Kenwolf, WH6BSZ	Your continued service to AMSAT in producing designs for shirts, banners, and AMSAT advertisements.
Drew Glasbrenner, KO4MA	Your continued service to AMSAT at Dayton and representing the organization at numerous hamfests throughout the year.
JoAnne Maenpaa, K9JKM	Your continued service to AMSAT in producing the weekly AMSAT News Service, invaluable work on the AMSAT Journal, and providing current information on the AMSAT Web site.
Dee Interdonato, NB2F	Your continued service to AMSAT in producing the weekly AMSAT News Service and additional duties for the Field Operations Team.
Ed Long, WA4SWJ	Your continued service to AMSAT in producing an outstanding AMSAT Journal.
Bruce Paige, KK5DO	Your continued service to AMSAT in producing the AMSAT Awards, working on the AMSAT on-line store, and the AMSAT Net.
Keith Pugh, W5IU	Your continued service to AMSAT representing AMSAT at multiple hamfests throughout the year, the 20 meter AMSAT Net, and your excellent service at Dayton.
James French, W8ISS	Your continued service to AMSAT in producing the weekly AMSAT Satellite Report.
Operations Awards	
Gould Smith, WA4SXM	Your continued dedication to AO-51 by serving as the primary command station. Your time and dedication exemplify the best type of AMSAT volunteer.
Mark Hammond, N8MH	Your continued service to AMSAT by serving as command station for AO-16, and now AO-51. Your enthusiasm for amateur satellites is contagious and refreshing.
Colin Hurst, VK5HI	Your continued service to AMSAT in the support of AO-51 with insightful, in-depth telemetry analysis and observations.
Ib Christoffersen, OZ1MY	Your continued support of AO-51 via the modes committee, fielding questions, and providing observations from Europe.
Kevin Schuchmann, WA6FWF	Your continued support of AO-51 as our west coast command station. Your time and abilities are an important part of the success of AO-51 and the Operations Team.
Ed Clayo, N8BBQ	Your enthusiasm and willingness to contribute to the AO-51 Modes Committee.
Doug Papay, KD8ACO	Your enthusiasm and willingness to contribute to the AO-51 Modes Committee.
ARISS Program Awards	
Frank Bauer, KA3HDO	Your commitment and leadership to ARISS has ensured quality ham radio educational outreach has continued over the years for students and teachers.
Kenneth Ransom, N5VHO	Your ongoing leadership as ARISS school scheduler and coordinator, and for your work at NASA Johnson Space Center with the ISS crew members.
Gould Smith, WA4SXM	Your outstanding coordination and technical guidance on the upcoming ARISS satellite.
Charles Sufana, AJ9N	Your continued leadership and support to the Operations Team through updating the ARISS school data pages and your longstanding work as the senior ARISS School Mentor.
Dave Taylor, W8AAS	Your ongoing leadership as the ARISS school scheduler, your work to garner mode ARISS telebridge stations, and your continued interest in helping ARISS where needed.
Lou McFadin, W5DID	Your continuing support for a number of important ARISS technical projects, including the upcoming ARISS satellite.
Will Marchant, KC6ROL	Your leadership and coordination work for the Richard Garriott ARISS activities, especially the SSTV activities, and the ARISS International Annual Meeting.



in the Space History Division at the Smithsonian Institution's National Air and Space Museum in Washington, D.C., where he curates the National Air and Space Museum's civilian applications satellites collection that includes weather, remote sensing, and communications satellites and related technologies. He has contributed to a series of Museum exhibits, and was primary author of the exhibition catalog, *Space Race: The U.S.-USSR Competition to Reach the Moon*. His recent efforts have explored the use of new media for exhibitions and other museum presentations. On the occasion of the 50th Anniversary of Sputnik, he was editor of *After Sputnik: 50 Years of the Space Age*, which included pages and photos on the history of Project OSCAR. He has been instrumental in arranging the display of Amateur Radio satellite history at the National Air and Space Museum's Udvar-Hazy Center. Dr. Collins talked about his top 10 events of the space program that have impacted civilian life over the past 50 years.

The banquet concluded with a drawing for door prizes provided by our sponsors. [Table 4]

Mark Hammond, N8MH, won the ICOM 910H satellite transceiver.

Prizes

Field Operations Meeting

Bright and early Sunday morning the Field Operations team held a breakfast meeting with nearly a third of the team present. Over the last year the Field Ops team was contacted and asked whether they wanted to continue being an active participant. The current team is about 47% of the team at the beginning of the year, but all the current team members will be active and responsive. The team discussed ways to improve communications and the importance of representing AMSAT at all the major hamfests as well as smaller, local hamfests. All Area Coordinators are expected to represent AMSAT at a hamfest, satellite demonstration or club presentation each year.

IARU International Satellite Forum

Art Feller, W4ART, reports that during the forum a number of suggestions to improve the frequency coordination form were taken. One of the important items that was presented was that the IARU Satellite Advisor, optionally, will keep space station turn-off procedures in case of interference and where the licensee cannot be found. Also a short paper on controlling satellites

has been added to the Web site.

ARISS Operations Team Meeting

The ARISS Operations team meeting was held in conjunction with the AMSAT Symposium. The timing allowed us to take advantage both of the presence of many team members and a meeting site. There were 10-15 people in attendance, plus remote attendees from as far away as Australia. Remote attendance was made possible by video and audio streaming provided by John, AG9D, and Greg, N9CHA, via both the British Amateur TV Club site and EchoLink.

The meeting was organized by Dave Taylor, W8AAS. It provided the ARISS Ops team an opportunity to discuss a variety of strategic topics that often get overlooked in the day-to-day crush to schedule and execute school contacts. Discussions were held on how to make the educational aspects of ARISS better and the team shared information on

how to improve the returns of surveys and evaluations. In particular, ARISS has been doing a great job on the "Inspire" position of the NASA Education Pyramid and goes a little into the "Educate" position, but meeting comments put great emphasis on getting much further into the "Educate" position. Among the topics discussed were:

- Educational goals of the ARISS program and how to help teachers with STEM (science, technology, engineering, and math) education while promoting ham radio.
- Pre- and post-contact information needs and record-keeping.
- Best practices for mentors, moderators, ground stations, and schools: what works well and what hasn't worked.
- Process improvement: what areas of ARISS operations could stand improvement and how might we approach it.



All the living AMSAT Presidents: Perry Klein, W3PK; Tom Clark, K3IO; Doug Loughmiller, KO5I; Bill Tynan, W3XO; Keith Baker, KB1SF; Robin Haighton, VE3FRH; Rick Hambly, W2GPS; Barry Baines, WD4ASW.

Table 4: Sponsors and Prize Donors for 2009 Symposium	
AMSAT Thanks Our Prize Donors!	
AMSAT	LVB tracker box
Anderson	Four packages of 10 30-amp Anderson Power Poles (4 prizes)
ARRL	One Satellite Handbook; One VHF Digital Handbook; One Periodicals CD; Two certificates for one-year subscriptions to QEX; One certificate for a copy of the 2010 ARRL Handbook (6 Prizes)
CQ Publications	Two one-year subscriptions to CQVHF (2 prizes)
Elk Antenna	Model 2M/440L5 Dual Band Antenna and Case
Flex Radio	Certificate for 50% off the Flex 5000 VHF/UHF Module
Ham Radio Outlet	2010 ARRL Handbook
ICOM	IC-910 Transceiver
Kenwood	Two \$100 gift certificates
Magellan	Magellan Triton 500 Handheld GPS Unit
NCG	Daiwa Coax Switch
QSL Man	250 QSL cards
RF Connection	Two Digital Clamp-on Meters (2 prizes)
Spectrum International	Quadrifilar Helix Antenna
WA4SXM	Autographed photo of Owen & Richard Garriott
Yaesu	FT-60 Dual Band Transceiver



Ham Radio Vacation in the Cayman Islands

by Adrian Engele, AA5UK/ZF2AE and ZF2AE/ZF8, aa5uk@yahoo.com

Every year my girlfriend Ellen and I have a big dilemma. Where do we go diving this year? We are both avid divers and are always on the lookout for a new adventure to a fun destination. We first considered the Philippines, but trying to use our frequent flyer miles proved useless, as no seats were available on any participating airline during the period when we normally go. After looking for travel deals on the Internet, we found Cayman Airlines was running a special and bought the tickets on the spot. Chicago to the Cayman Islands direct for under \$400, what a deal! The plan was to leave March 25th and return April 8th. So once we knew where we were going, I could start planning my Amateur Radio activities.

Looking at the calendar, I saw CQ WPX was going to take place during the weekend of March 28 and 29th. The thought of getting on the air during a contest was very appealing to me; we would be on Little Cayman. I looked around the Internet and saw there was little satellite activity from EK99 and adding satellite operations during my vacation would make many operators happy. I was also reminded of my poor satellite endeavors from the previous year, when I was on St. Maarten (PJ7) and Saba (PJ6). At that time I had my VX7R

during TCA. I had mistakenly inverted the receive frequencies. All I could do was shake my head for making that mistake. I was determined this time to get all the programmed channels properly programmed and all the gear in order before our trip.

In late February, I sent Drew, KO4MA, an email to find out the AO-51 schedule for March and April, as it had not been posted yet. After several emails, Drew convinced me to add the linear satellites to my operational plans. It was easy to do with a single transceiver he said; in my case a FT-857D, SatPC and a CAT interface would do it. I went ahead downloaded the program, played with it and opted to get a license for it. This would be my first adventure into working half-duplex using computer CAT control.

Next step was the license. I contacted ICTA, which is the equivalent of the FCC in the Caymans. Nikki Forbes answered the phone and was able to get me a license within two days. She called me and gave me a choice of calls. I picked ZF2AE. Since I was also going to Little Cayman I could sign ZF2AE/ZF8. The process was straightforward, inexpensive and painless. I had my call e-mailed to me and received the original license with the customs import forms within a week's time by regular mail.

Several weeks before my trip, I received numerous sked requests based on the news announcement on the AMSAT board. Gail, KB0RZD, was the first to drop me a note asking me if I would work him both from a Florida grid and from his Kansas home QTH. We corresponded extensively over the weeks prior to my trip and arranged our skeds.

Looking over my gear, I decided holding my Arrow antenna by hand was not going to cut it, especially when working the linear satellites. I headed to my favorite camera store Helix Camera here in Chicago. I looked at many tripods in all price ranges and really did not see anything I liked. After consulting with one of the sales people, I found a sturdy and short tripod, perfect for the suitcase. After explaining to the sales person what I was planning to do, he recommended a ball swivel mount by Promaster that was designed for heavy cameras and professional video cameras. I really liked it as it would give me better movement during each pass being a ball swivel mount. Also the

mounting plate had two screws instead of the usual single screw. This would make the attachment to my Arrow antenna much sturdier after drilling an additional hole into the boom. Yes the mount was pricey, but after using it I was happy with my decision to go for it, as it would prove to be invaluable in making antenna handling and satellite tracking a joy.

One item that I found invaluable was the addition of an Advanced Receiver Research 70 cm 25W RF switched pre-amplifier, which I picked up at the last minute. I decided to battery power it via a small battery pack with Anderson Powerpoles. During one of my best passes, I wasn't paying attention and managed to rip out the negative lead. After a quick head shake, I quickly improvised by stripping the wire with a pocket knife and sticking it back by hand into the connector. I managed to complete the pass with a big giggle while antenna tracking, working the Doppler change and holding the connector in my hand. Talk about multitasking. Since I had no access to a soldering iron, I wound up using some black electrical tape to hold the connection in place for the rest of the trip. It was worth adding the pre-amp as it did wonders on all passes with a 70 cm downlink.

We arrived on Grand Cayman on March 25th and decided to stay on the west side of the island known as Seven Mile Beach. After settling in, I decided to go to the parking lot of our hotel and I plugged my FT-857D



Little Cayman Airport

programmed with the various FM satellites and tried to make some contacts for the first time since the RS10/RS12 days. It's been a very long time since those grand old days for those wonderful satellites. I made a few contacts then, but I was having a rough time getting into the satellites. In preparation for the Cayman trip, I rechecked all the frequency pairs that I had previously programmed and realized I had incorrectly programmed some frequencies which only allowed me to properly receive the satellites



Arrow and the sunset at EK99kp



Friendly Iguana that just wanted to get on the sats!

into the cigarette lighter of the car and fired up SatPC on the laptop. My first pass on VO-52 was an utter failure. I was trying to contact Todd, N4QWZ. I quickly realized I had not properly set the timing on the Doppler shift change setting; it was set too fast and poor Todd could not keep up with me as the frequency changed continuously. I soon figured out the problem, but by that time the pass had come and gone. FO-29 was only a few minutes away and this time Todd and I were able to get EK99hi into his log. I worked many stations over the coming days and often received some strange looks and many interesting questions from people at the hotel who saw me operating from the parking lot. I encountered one lady walking her dog each evening and she seemed fascinated by this crazy ham talking over satellites. We saw each other a few more times and she waved each time.

On the 28th, we took a twenty seat Twin Otter over to Little Cayman, grid EK99xp. This is a small island about 10 miles by 1 mile in size with a population of 170 people. It is well known for great diving and fishing. CQ WPX was in full swing when we landed. I had to scramble to get my HF antenna up only to find the 50 foot trees at the resort from past visits had been cut down by the



Twin Otter at Little Cayman airport

aviation authorities. I was later told they were considered a safety hazard to the planes arriving or departing only a few hundred feet away. I found some smaller trees but they were nothing compared to the old big trees. I managed to get a few satellite passes in before spending the rest of the afternoon and evening on the WPX contest.

Since the island is very flat with no tall structures, it was easy to work passes almost horizon to horizon. I found AO-51 and SO-50 passes mostly in the early mornings before my dives and the late afternoons. FO-29, VU-52 and AO-7 passes were best in the late evenings. These were the most time consuming to setup on a portable basis. The resort loaned me a 50 foot extension cord so I could run my FT-857D away from our cabin. I had my radio gear set up on a beach chair with my laptop and tripod with the Arrow antenna to the side of me. Little land Hermit crabs were all around me most evenings and I had to watch out not to step on them as they kept me company during some of my passes. During the day time we would get stares from the abundant iguanas that live on the islands and wondered what I was doing every day as I invaded their turf during my satellite contacts.

Rick, WA4NVM, sent me an e-mail asking me if I had any plans to be in the FK09 grid. I looked at a grid square map and realized that the Eastern-most tip was in FK09ar and FK09aq. Since we did not have a rental car, I did not have a chance to make it over there. Mark that one down to poor planning. Next time, I'll add that grid to the operations list.

On April 3rd, we flew back to Grand Cayman and we stayed on the East end in EK99kh at Compass Point. This lovely resort has a nice long pier which was perfect for setting up for most passes. I could track the satellites rising above the horizon with many Central American, Mexican and Venezuelan stations popping up. Unfortunately AO-51 often suffered from serious cordless phone interference making a good portion of some passes useless until the satellite was out of the footprint of the interference. In the evenings, I would set up by the pool which had a nice elevated deck and a power outlet for my Yaesu to work the linear satellites. I managed to work quite a few more stations over the coming days with the final contact going to Sebastian, W4AS.

In the end, I worked forty eight passes, making 139 contacts in 52 grids and six

countries, holiday style. I found working the FM satellites with an Arrow Antenna and a 5W HT a challenge, when sharing passes with high powered fixed stations. Adding a second FM radio to work full duplex is definitely a plus. Something I will consider for the next trip. The linear satellites were easy in comparison, even with the challenges of working half duplex. Many stations went out of their way to work me often. One observation, I found many base stations calling CQ again and again, but nobody would respond when someone called back. There were also many lost opportunities where stations who called me were being stepped on by the previously mentioned stations. I found this was a common occurrence regardless if the stations were stateside or foreign.



Cabin in Little Cayman

Lessons learned: Prepare, prepare and then prepare. Double check all the gear, bring spare connectors and parts when going to a DX location. There typically won't be a Radio Shack in these foreign locations. Prepare a printout of all the passes and forward that list with likely passes and availability. I found this very helpful in setting up skeds and determining the elevation and duration of specific passes. Also if you have a small radio like a FT-857 or an IC-7000, make sure you remove the control head and put it in hard or padded case. I found out my radio was damaged when my carry on was taken away from me because the flight was full and there was no room for my carry-on luggage. Upon arrival, I found my radio was damaged in transit when it was stuffed into the cargo hold on the Twin Otter.

I was happy to activate EK99 for the many stations that needed the new grid, a new country or a new Island. I was particularly pleased with the daily e-mails of encouragement from fellow operators and sked requests. The best part where all the nice QSL cards with wonderful personal notes that filled my mailbox upon my return.



When I first planned for this trip, my goal was to operate very casually on the satellites. In the end, this turned out to be a bigger operation than expected. I regret not having worked more operators on the linear birds as activity was quite low. Often I had the satellite all to myself. I also regret Juan, LU2DPW, and I could not find a suitable time to manage a contact on AO7 before my departure. We corresponded by e-mail several times, but the timing was just not right and the window was short between our locations. I managed to give Gail, KB0RZD, his needed contacts for his VUCC. Also I managed to get Patrick, WD9EWK, his Cayman contact on an SO-50 pass.

I would like to give thanks to Drew, KO4MA, for encouraging me to try the linear satellites to give me additional experience. Also thanks to Gail, KB0RZD, Tim, N3TL, John, K8YSE, David, KG4ZLB, John, N4QWF, Rick, WA4NVM, Patrick, WD9EWK, and many others who made it in the log and who sent me numerous e-mails of thanks and encouragement. Finally, I would like to thank Ellen for her patience and her appreciation of my love for Amateur Radio. In the end, I learned much for the next trip and had lots of fun meeting lots of new friends. Especially those I met at Dayton in May.

In addition to the Cayman Islands, I was active on the satellites from BL02 and BL11 in March 2010. Stay tuned for more information on that trip: Aloha! 🌺



ZF2AE/ZF8 at EK99xp

AMSAT is the North American distributor of **SatPC32**, a tracking program designed for ham satellite applications. For Windows 95, 98, NT, ME, 2000, XP, Vista, Windows 7.

Version 12.8a is compatible with Windows 7 and features enhanced support for tuning multiple radios.

Version 12.8a features:

- Select 2D/3D map with a single mouse click
- Select Political/Physical map with a single mouse click
- AOS voice announcement
- Countdown program displays next AOS of your favorite satellites
- Automatic Internet download of Keplerian elements.
- Graphical tracking on a world map with two selectable Zoom factors.
- One-click satellite switching using 12 "letter" buttons.
- Automatic rotor control support for: LVBTracker, Kansas City Tracker/Tuner, FODtrack, Uni_Trac, SatEL, Labjack U12/U3/Piggyback, W0LMD Mini/Junior/Senior Trackers, Yaesu GS-232, ARS from EA4TX, EGIS rotors, IF-100, RIF-PC, AMSAT-DL interface, WinRotor32, HalloRotor, and WiSP DDE clients.
- Doppler tuning with on-screen frequency displays. Radio models supported:
Yaesu FT-847, FT-736R, FT-817, FT-857, FT-897
ICOM IC-820H, IC-821H, IC-910H and other ICOM radios
Kenwood TS-790 and TS-2000
DDE client programs
- "Transparent" VFO-knob tuning in addition to keyboard and mouse tuning.
- "Virtual" VFO tracking for half-duplex transceivers FT-817, FT-857, FT-897, IC-706 and IC-7000.
- Includes a special version for ISS split-frequency operation.
- Controls subaudible tone on FT-847, FT-736R, FT-817/857/897, TS790A and IC-910H.
- Includes a non-graphical version and programs that output lists to the screen, printer, or a file.
- Interfaces with WiSP, with user-defined satellite switching priority.
- Includes a separate program for tracking the Sun and Moon.

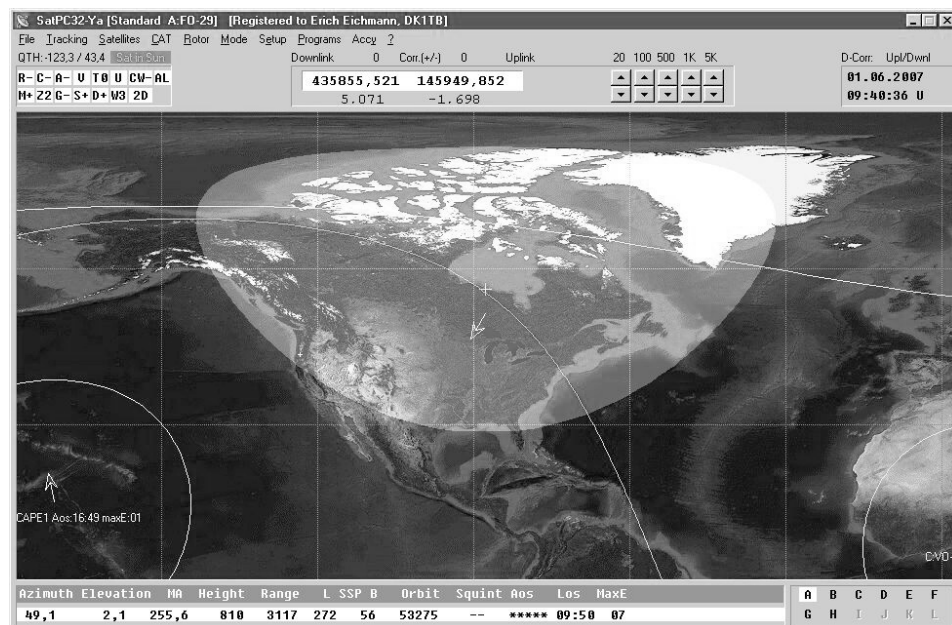
Minimum Donation is \$45 for AMSAT members, \$50 for non-members, on CD-ROM.

A demo version may be downloaded from <http://www.dk1tb.de/indexeng.htm>

A registration password for the demo version may be obtained for a minimum donation of \$40 for members and \$45 for non-members.

Order by calling 1-888-322-6728.

The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



AMSAT Board of Directors Meeting Minutes October 8 & 9, 2009 Baltimore, MD Alan Biddle, WA4SCA, Secretary

The meeting was called to order by AMSAT President Barry Baines, WD4ASW, at 0808 EDT on Thursday, October 8, 2009.

Members of the Board of Directors present:

Barry Baines, WD4ASW
Tom Clark, K3IO
Drew Glasbrenner, KO4MA
Lou McFadin, W5DID
Gould Smith, WA4SXM
Bill Ress, N6GHZ
Alan Biddle, WA4SCA
Tony Monteiro, AA2TX (Alternate)

Other officers present were:
Martha Saragovitz

AMSAT members participating and/or observing on both days included:

Jim Heck, G3GWM
Keith Pugh, W5IU
Keith Baker, KB1SF/VA3KSF
Dave Taylor, W8AAS
Patrick Stoddard, WD9EWK/VA7EWK
Dee Interdonato, NB2F
Dave Jordon, AA4KN
Pat Kilroy, N8PK
Nick Pugh, K5QXJ
Bill Tynan, W3XO
John Klingehoffer, WB4LMN
Bob Davis, KF4KSS
Doug Quagliana, KA2UPW
Bob McGwier, N4HY
Perry Klein, W3PK
Brian Klofas, KF6ZEO
Dan Schultz, N8FGV
Larry Koziel, K8MU
Bob Carpenter, W3OTC
JoAnne Maenpaa, K9JKM
John Shew, N4QQ
Jennifer Rojowski, N8GZL
Frank Bauer, KA3HDO
Joe Fitzgerald, KM1P
Douglas Quagliana, KA2UPW
Phil Karn, KA9Q
Steve Diggs, W4EPI
Bill Hook, W3QBC
Rick Hambly, W2GPS
Jerry Ervine, KC5YRE

Barry Baines began by announcing that Tony Monteiro, AA2TX, had accepted appointment as the Vice-President for Engineering.

The following Officers were elected by unanimous vote:

Vice President Operations, Drew Glasbrenner, KO4MA
Vice President of User Services, Gould Smith, WA4SXM
Vice President of Engineering, Tony Monteiro, AA2TX
Secretary, Alan Biddle, WA4SCA

Manager, Martha Saragovitz
President, Barry Baines, WD4ASW, and Treasurer, Gunther Meisse, W8GSM, were elected with 6 ayes, 1 nay votes.

The following Officer positions are currently open:

Executive Vice President
Vice President Human Spaceflight
Vice President Marketing
Executive and Other Team Reports

President's report for 2009 provided by Barry Baines, WD4ASW

Barry observed that after a low last year after the Atlanta meeting, we are on an upswing in many areas. The limitations on cooperation imposed by the International Traffic in Arms Regulations (ITAR) have stopped all interaction between AMSAT, both collectively and by individual members, with the organizations and individuals of other countries. This has been addressed with a Self Disclosure submission to clear any past infractions, and requests for Commodity Jurisdiction status which will simplify future cooperation by moving from State Department to Commerce Department jurisdiction and rules. Results of the Commodity Jurisdiction requests are expected in the near future.

A new location for the AMSAT laboratory is being developed, and should be better than the previous location due to proximity to the hosting organization. A working agreement is currently being developed. The existing clean room is still the subject of legal action. A final effort at a mediated resolution will be made in the near future, with a court date set in early 2010 if this is not possible.

Recently, AMSAT was approached by a consortium consisting of SUNY-Binghamton, NY and IBM to provide a low level of funding for a few students, and some mentoring. This would involve research and development in areas of interest to AMSAT without a major commitment but with the potential for large returns.

Over the past year, an engineering task force has been reviewing AMSAT's internal resources and commitments, with the aim of finding a way forward to "Return AMSAT to Space." This has been completed. Meanwhile, SuitSat-2, now called ARISSat-1, is making good progress and should be ready for transport to the launch site this fall. Despite the turbulence within AMSAT, we still have a team of motivated volunteers, and are looking to fill the open vice president positions.

Secretary's report for 2009 provided by Alan Biddle, WA4SCA

Minutes of the 2008 Atlanta meeting have been published in *The AMSAT Journal*. Barry moved and Drew seconded that the minutes as published.

The motion carried unanimously.

The minutes of the September 1, 2009 board meeting by telephone conference, held to approve the agreement and funding with SUNY-Binghamton, were circulated. It was moved by Barry and seconded by Drew that these be approved. The motion carried unanimously. These minutes will be published in an upcoming issue of *The AMSAT Journal*.

Treasurer's and IT Report for 2009 provided by Barry Baines, WD4ASW, and others as the treasurer, Gunther Meisse, W8GSM, was unable to attend

Martha distributed the audit report from Berlin, Ramos & Co. Two questions were raised. The first by Lou covered the appropriateness of including Eagle in assets. Drew asked for clarification of what was meant by "satellite operations." These were partially resolved, with more precise answers to be received later after consultation with Gunther. After reviewing the document, Barry moved and Tom seconded a motion to approve it. The motion was approved unanimously. Barry moved, and Alan seconded, a motion to retain the firm in the upcoming year. This was also approved unanimously.

AMSAT 2009 Financial Operations Summary provided by Gunther Meisse, W8GSM, AMSAT Treasurer after the close of the meeting

2008 was a troubling year for most of us. AMSAT was no exception. We suffered losses within our reserves totaling some \$171,351.75 as the markets took a dive. Our operating income totaled \$319,391.00 with operating expenses totaling \$321,585.00 resulting in an operating loss of \$2,194.00, excluding unrealized investment losses. I am sure it is correct to say that the down market affected our donations in the latter half of the year. All in all, we ended the year in a reasonable cash position.

2009 is a much better year as we have seen substantial recovery gains in our reserve investments and the overall attitude among members is much more up-beat. As of September 2009 we were operating at a \$16,990.98 profit, thanks to a market value gain year-to-date in our investments of \$68,887.44. We look forward to that growth continuing into 2010. The board is diligently finalizing the 2010 budget with an eye to new projects for the 2010 ~ 2011 period. Our 2008 audited financials and IRS 990 tax returns are available for review at our Web site: www.amsat.org

ARISS Report

Dave Taylor, W8AAS, gave a brief informal report. Contacts, both coordinated and opportunity, are



growing steadily. Activity levels depend on both workloads and the interests of the ISS crew.

Lou, W5DID, gave a report on current and future operations. The SSTV module currently hangs up. Tests indicate an RF problem, and a cure is being developed. The D-700 has a PTT problem when working with the VC-H1 which tests indicate as being a loose wire. A battery eliminator for the VC-H1 is being developed. The Columbus module HF station power supply is still being worked on. HF antenna has been installed, but has a very high SWR. A fix has been developed, but this will require an EVA. A full system consisting of an FT-817 and tuner has already been procured. A primary concern is the development of battery backup power for the amateur station. This is in support of the justification to provide backup communication in case of the failure of normal communications. Units have been designed and tested, but need program office approval for flight units. The D-700 transceiver has a need to provide a way to update the configuration programming, as well as restore it easily. Doing so is complicated by restrictions on ISS computers. An external dongle is being considered. Lou reports that the new V/U antennas have been delivered, and will be installed on the STS-129 EVA. Both 13 V and 28 V power distribution systems are being developed. The Next Generation ISS-Ham station, proposed in 1998, is now technologically possible. It will support a wide range of user skill with multiple bands and modes. Finally, an additional telebridge station is needed in New Zealand, but third party restrictions are hindering this.

ARISSat-1

Gould discussed the transition of the Suitsat-2 to ARISSat-1 made necessary by the removal of the Russian Orlan spacesuit due to space requirements on the ISS. This has resulted in the components being repackaged in a more usual satellite configuration. The existence of solar panels and more sophisticated electronics will allow simultaneous telemetry and various voice modes. The launch costs will be absorbed by the Russian Federal Space Agency, with the satellite to be hand launched from the ISS. The battery will also be supplied by the Russians, to be installed in orbit for safety reasons. A working prototype was displayed at the symposium. A few final software capability updates are to be made. Both Barry and Bill asked about the probability of timely delivery. The project is on schedule for delivery in November of this year, to be launched from Russian in 2010. (For more detailed information, see the following papers in the 2009 Conference Proceedings: "ARISSat-1 Mechanical Design," Robert Davis, KF4KSS. "Software Radio Technology on ARISSat-1," Anthony Monteiro, AA2TX. "The ARISSat-1 Linear U/V Transponder," Bill Ress, N6GHZ.)

Tom initiated a discussion on the current and future NASA interest in the educational parts of ARISS. The Educational Office is always

interested, but support needs to exist in other parts of the agency. It is currently good, but Barry emphasized we need to continue to maintain and even improve credibility. This support makes possible projects which do not have launch costs associated with them. Tom emphasized that AMSAT needs to have access and participation on external review boards.

15 Minute Break

AMSAT Store by Martha

Martha reports that Rick Hambly, W2GPS, is handling the store and associate Web site. It is working smoothly. In addition, Martha was able to obtain a state of Maryland tax exemption for us, which is resulting in significant savings in both the store and other AMSAT purchases.

Satellite Operations Report by Drew Glasbrenner, KO4MA

AO-7 hardware, within its limitations, continues to function well. It is easily the most popular SSB/CW satellite primarily due to its large footprint. There are no plans to actively manage the satellite. However, some experimental tests may be run in the eclipse period to allow system reset. Concern was expressed that the license trustee is not a core AMSAT member. Drew will take the lead in moving the trusteeship.

AO-16 is still too cold to operate without constantly being reset by a control operator. This condition will continue for a period of years.

IO-26 is in good condition. AMSAT-IT is amenable to bringing it back into service, but there have been problems with locating the control software.

AO-51 also continues to operate well. However, the batteries are beginning to weaken. This is not a factor in periods of extended sunlight, but will limit some modes such as Mode S during periods of eclipse. A Command Station and Operations Committee to coordinate the various modes and user requests has been created and expanded. While the FM V/U repeaters still represent the core of operations and interest, other modes are frequently requested. SSTV is very popular, and the Apollo 11 moon landing commemorative broadcast had many listeners with positive comments. The QSL cards for reception should be ready soon. Dr. Jay Garlitz, AA4FL, has restarted the College Satellite Night. Several university stations have been active. Drew has established a kit and instructions for use by DXpeditions. The K5D satellite operation from Desecheo Island was the first and highly successful result. (For more detailed information, see "Lessons Learned at LEO: Implications for Future AMSAT Projects," by Andrew Glasbrenner, KO4MA in the 2009 Conference Proceedings.)

User Services Report by Gould Smith, WA4SXM

There has been a continuing drop in membership, especially for non-North Americans. The reasons for this, including the economy and ITAR issues

were discussed.

The AMSAT Journal is often delayed due to a lack of articles. Barry suggested that AMSAT officers should write brief quarterly reports to be published.

The AMSAT store is selling clothing and trinkets well, but is suffering from a lack of new software.

AMSAT nets continue. The HF net has a few loyal members. Other local and regional nets have moved to linked repeaters and/or Echolink facilities.

AMSAT continues to be represented at larger hamfests, both with booths and forums. However, hamfests are getting smaller, and some have been discontinued. Still, not all hamfests are covered. Gould reported that Area Coordinator lists have been purged of inactive members, and efforts are being made to fill the gaps. Unfortunately, there have been only 11 responses to the recruiting ads running in the *Journal*. In 2010 the plan is to improve Field Operations using the FOSS system to improve the level and number of hamfest presences.

Dayton 2009 was the 40th anniversary of AMSAT. Both Richard, W5KWQ, and Owen Garriott, W5LFL, were huge draws and were present at the booth and other AMSAT activities. The display of "Forty Years in Space" as well as the SuitSat-2 prototype were well received. The LVB Trackers as usual sold well. Booth support by AMSAT volunteers was good. Next year, the engineering section will expand to include mini-talks. As always, DARA gave us excellent support, and made a donation.

Adjourned for lunch 1230-1330

Detailed Discussion of Ongoing Issues

Barry began by revisiting the ITAR issues. He emphasized that this was a serious issue, with potentially harsh legal consequences, especially for our volunteers who are also professionals in the field. Our inability to interact with foreign AMSAT groups has hindered several projects, and has produced unfortunate friction. Even some US members have been reluctant to continue involvement within AMSAT until the situation of compliance is clarified. Harold Price, NK6K, has in the past generously allowed AMSAT groups to use freely his Spacecraft Operating System. Under ITAR, that will no longer be possible.

To clarify this issue, AMSAT has submitted a Voluntary Disclosure to the Department of State. This has the effect of giving amnesty for any previous infractions. The results were received from the Department of State shortly before the meeting. It stated that violations did occur, though no details were given. In order to insure future compliance, we are going to request clarification of past infractions, and institute ITAR compliance training for members working on delicate projects. Additionally, formal requests for Commodity Jurisdiction status of key satellite



technologies has been made. If granted, these will move the issue to the Department of Commerce which will greatly simplify foreign interactions. The results of this application are expected in the near future. If successful, it will set a precedent for future issues.

Barry then discussed the history and current status of the AMSAT laboratory equipment and clean room litigation. At present, we have the equipment, but not the clean room. The week after this meeting both parties will meet for mediation to resolve the issue. If this fails, it will go to court in early 2010.

Due to the failure of the HISS arrangement, AMSAT has been looking for a new partner for a laboratory site. Drew made contact initially with Dr. Fitz-Coy of the University of Florida. This has proceeded well. It has the potential for both excellent facilities, and mutually beneficial interaction with the university satellite community. Keith Baker, KB1SF, inquired whether the clean room was covered in the Memorandum of Understanding. It is, though only about half of it is needed or wanted in the new facility by either party. Barry added that the agreement with SUNY-Binghamton and the IBM System Engineering Center would not conflict with the ongoing lab negotiations. All parties are aware of each other.

Bill gave a review of the Engineering Task Force review during the past year. This was a wide ranging review of technologies, costs, launch opportunities, and even politics. The results of this review are the recommendations contained in "Getting AMSAT Back in Space." He summarized this as using the emerging CubeSat technologies, with involvement in concept studies. Several present indicated concern with CubeSats due to limitations on coverage and useful lifetime. Keith Baker noted that most had very short lifetimes by design. Brian Klofas, KF6ZEO, reported that there was a high failure rate due to poor execution. Alan noted that university projects are considered largely successful due to the planning, development and construction learning experiences, even if the spacecraft fails after launch. This causes a different mindset in construction.

Due to the lack of available rides to high or even medium earth orbits, there has been considerable interest and even pressure to use propulsion systems. Tom and Bob McGwier, N4HY, made the case that issues involving both guidance and propulsion make this a poor risk in the near term. Lou also discussed the use of propulsion devices from safety and regulatory standpoints with the ISS.

Jim Heck, G3GWM, and Martha both emphasized that we need a few tightly focused goals rather than a variety of projects. Finally, Drew reiterated that most of the traditional launch opportunities were no longer available, while university opportunities are increasing rapidly. A tighter AMSAT-university integration was strongly

supported by Perry Kline, W3PK, Lou, Tom, and Alan among others.

Gould discussed issues of concern in the postings to the AMSAT-BB list which have caused problems with individuals and agencies outside AMSAT. There was a consensus, though a reluctant one, that these issues need to be addressed and resolved. Barry suggested that any considerations include an integrated package for handling this and other functions such as the alias forwarding list and various AMSAT working groups. Both Tom and Drew advocated moving to a topic type forum, with some examples given by Drew. A spirited discussion involving all board members, and several observers, followed. No formal decision was made, but options will be investigated for a decision in the near future.

Gould reviewed the operation of the www.amsat.org Web site. The current custom software is extremely labor intensive to administer, and there are now packages readily available which will simplify both the maintenance and development. Joomla was mentioned as a good example of current Open Source applications. After an extensive technical discussion, it was decided to keep the AMSAT Store on the current server while migrating to a newer platform. Some of the responses to the AMSAT recruiting notices in the *Journal* are from people who have expertise in these areas.

The existing method of handling volunteers is functional, but requires human intervention to route the message to the correct individual. This is not always timely, nor is the correct routing obvious. Martha pointed out that the categories do not always reflect the current structure and needs of AMSAT. Changing the routing directly to officers may be a good interim solution.

Tony reviewed engineering management issues developed by the Engineering Task Force. ARISSat-1 is the current, most urgent project. It is basically an educational project, but one which will allow significant development of AMSAT resources. Based on proposals to and by the Engineering Task Force, the next project will be a CubeSat. Tony also touched on weakness in the internal processes, and the need to make the process more structured. Tom emphasized this would be critical in more complex projects. Bill Tynan, W3XO, and Lou specifically noted the need for accurate interface definitions. Barry summed this up by stating that a culture change was needed and underway.

As part of this, Tony is going to continue the Engineering Task Force as an informal advisory group to look at technology areas. Tom specifically suggested batteries, RF power, and navigation for consideration. This effort will provide AMSAT an opportunity to engage other groups with our expertise, and to make it easy for those groups to add payloads of amateur interest to their projects.

Engineering Task Force Proposal to the Board

1. Fund the construction and launch of a 1U (1 Unit) CubeSat.
2. Continue support of the ARISSat Program.
3. Continue to monitor launch opportunities for large satellites and ride share opportunities.
4. Start technology concept development applicable to advances 1U CubeSats, 3U CubeSats, Microsats, or ride share satellites.

Barry moved, and Alan seconded that the recommendations of the Engineering Task Force be accepted. It was approved unanimously.

Drew felt that item 1 was not specific enough. Based on elements of the Engineering Task Force, several baseline features were itemized.

1. A mode U/V transponder, not done before in a 1U CubeSat, which can be worked with an HT and simple antenna.
2. A mode V telemetry beacon.
3. A mode U command receiver.
4. A simple IHU.
5. Deployable solar panels.

The addition of these guidelines was moved by Barry and seconded by Tom. They were approved unanimously.

Dinner Break 1800-1915

Bill Ress began with "ITAR for Dummies," a practical overview of the realities imposed by ITAR. Barry touched briefly on the issues and misunderstandings with our satellite partners, and reintegrated the need to insure full understanding by them of the constraints on AMSAT. While not relevant to most members, ITAR compliance training is essential for senior officers and those working on projects even potentially involving international cooperation. Bill reports that an ITAR Policy Manual is being developed.

Gould discussed the current AMSAT structure. Officer responsibilities are in some areas overlapping and unclear, with some other areas not address currently. Martha considered the current arrangement both bureaucratic and impractical for a volunteer organization our size. Barry will undertake a review, and solicit inputs.

Martha conducted a review of the budgeting process, including the estimation process based on officer and project leader inputs. A spirited discussion ensued concerning the appropriateness of some satellites carried as capital equipment, and various technical matters of the budget structure. (Please see report post-meeting report by the Treasurer above.)

The meeting was adjourned for the day at 2102 EDT

Meeting resumed in open session at 0800 EDT, October 9 2009

Martha and Bob Carpenter, W3OTC, began



with a discussion of the AMSAT Integrated Management System currently in use. The current system is 25 years old, and not compatible with newer computer operating systems. It is also very labor intensive for more than routine data entry and modifications. "Exceed!" by Telosa was discussed as an example of the requirements for new software. It supports gift and grant tracking, donor and volunteer management. Estimates for the initial configuration and migration of the existing data bases are approximately \$5-6k. Tom emphasized that we need a fully integrated system to manage all out data bases. Barry added that usability, supportability, flexibility and an underlying structure which will not become obsolete are essential. The search committee will be expanded to include Gould Smith, Gunther Meisse, and Bob Carpenter.

The 2010 Symposium location has not been chosen, though there are some candidates. Barry asked whether we need an annual meeting, or something less often. Alan emphasized the need to continue. Attendance at meetings, whether monthly or yearly, is partially a habit which when broken is hard to reestablish. Keith suggested the possibility of combining our meeting with another group with overlapping interests, such as TAPR or the Central States VHF Conference. This in turn lead to a discussion by all as to whether we should maintain a core symposium planning group such as is used by TAPR regardless of the location. Currently, AMSAT meetings are coordinated by a local group or organization. Chicago is currently being considered for the 2010 meeting. In closing the issue, Tom suggested that we go to an on line brief summary or abstract of the meeting.

Closed Session 0900 – 1045 EDT

A closed session, open only to board members and invited guests, to deal with a variety of issues. These included the Office Manager performance and compensation review, legal issues, and sensitive issues of various sorts such as discussions currently under Non-Disclosure Agreements.

Resuming the open session, Alex Harvilchuck, N3NP, discussed the NextGen CubeSat concept. Basically, it involves a pairing of AMAT-NA mentors, a small contribution to the SUNY-Binghamton "Capstone" engineering project, with support from the IBM Global Services Systems Engineering Division. The study will involve study and documentation of the ARISSat-1, with the goal of developing smaller, modular designs applicable to the standard CubeSat configuration, including deployable solar arrays and replacing traditional batteries with "super capacitors." The intent is to minimize the basic engineering functions volume and mass so as to maximize the amateur communication payloads. An engineering mockup should be available by Dayton 2010. (For more detailed information, see: "AMSAT NextGen Satellite Project," by Alex Harvilchuck, N3NP, and the NextGen Satellite Team in the 2009 Conference Proceedings.) The

presentation was well received, though issues involving foreign student participation and ITAR were raised. Finally, there was some concern expressed, particularly by Bob McGwier, N4HY, that the scope was too broad for the available resources.

After relocating to another room, the meeting ended with a final discussion of more technical discussions of budgeting categories. The last item of business was submission of various people for special recognition for their contributions over the past year.

Tom moved and Alan seconded that the 2009 Board meeting be adjourned. This was approved unanimously at 1300 EDT.

Cited for special recognition for contributions in the past year:

Frank, KA3HDO, and Janet Bauer. - For their outstanding willingness to Chair the 2009 AMSAT Symposium.

Gould Smith, WA4SXM, Mark Hammond, N8MH, Kevin Schuchmann, WA6FWF. – The AO-51 command team for keeping AO-51 alive.

Colin Hurst, VK5HI. - Telemetry acquisition and analysis.

Ed Clayo, N8BBQ and Doug Papay, KD8CAO. - Work on the Apollo Special event and other AO-51 matters.

Jim White, WD0E, Mark Kanawati, N4TPY, and the entire SpaceQuest team. - Continued on-orbit support of AO-51.

Ib Christoffersen. OZ1MY. - Observations and mentoring from Europe.

Ed Long, WA4SWJ. - For his excellent service as Editor of *The AMSAT Journal*

Dan Shultz, N8FGV. - For bringing the Proceedings together.

Gould Smith, WA4XSM, Lou McFadin, W5DID, Bill Ress, N6GHZ, and the entire team. - For ARISSat-1.

Perry Klein, W3PK. - For providing the video facilities for the LCROSS event.

Martha Saragovitz. - For decades of service.

Tim Lilley, N3TL. - For his outstanding work as Prize Chairman of the 2009 AMSAT Symposium.

Bill Hook, W3QBC. - For his continued support of the AMSAT Office.

Bob Carpenter, W3OTC. - For his continued support of the AMSAT computer and database.

Frank, KA3HDO, and Janet Bauer. - For their outstanding willingness to Chair the 2009 AMSAT Symposium and making it a great success.

JoAnne Maenpaa, K9JKM. – For her support of the various AMSAT news and information services.

Mike Young, WB8CXO. - For work on the LVB tracker boxes.

Frank Bauer, KA3HDO. - For his years of support to ARISS.

Doug Papay, KD8CAO, Jeff Thomas, K7WIN, Mark Hammond, N8MH, Alan Biddle, WA4SCA, Robert Dickey, AK5V, David Worboys, KG4ZLB, Dale Hershberger, KL7XJ, Robert Johnson, W7LRD, Ed Clayo, N8BBQ, Dave Aitch, G1OCN, Francesco Grappi, IW4DVZ, Masahiro Arai, JN1GKZ, Tetsuro Satou, JA0CAW, Yoshitomo Iji, JA6PL, and Allan Saul, ZS1LS. - For being uplink stations for the Apollo 11 memorial event.

Tom moved and Alan seconded a motion adjourn. Motion carried unanimously at 1300 EDT. 🌐

From ANS

USSTRATCOM Approves Continued AMSAT TLE Distribution

AMSAT-NA Orbital Data Manager Ray Hoad, WA5QGD said this week, "I am pleased to announce that AMSAT NA has received approval to continue redistribution of Keplerian elements from the USSTRATCOM data source (Space Track Web site) for the period April 1, 2010 to April 1, 2011.

Thanks to the USSTRATCOM team and especially to Mr. Mark Riddle for their help in this process."

This means that the AMSAT Keplerian Elements in verbose format and the 2-line format can be freely distributed by those who receive them from AMSAT. AMSAT's two formats are each considered an AMSAT product and therefore can be freely distributed. AMSAT asks that AMSAT-NA be given credit as the source for your redistribution. 🌐





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Documentation for the LVB Tracker can be found at: <http://www.LVBTracker.com>

Boards and complete units may be ordered from the AMSAT office at 301-589-6062 or from martha@amsat.org

THE R.F. CONNECTION

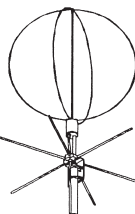
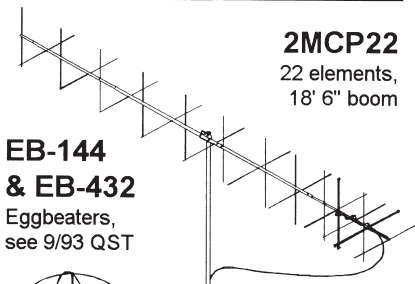
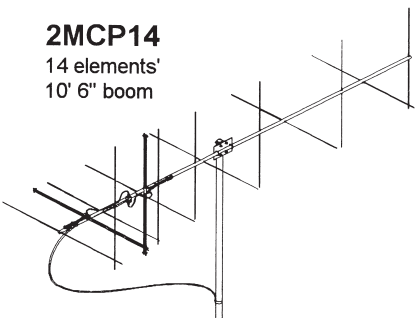
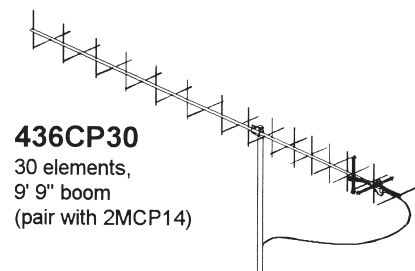
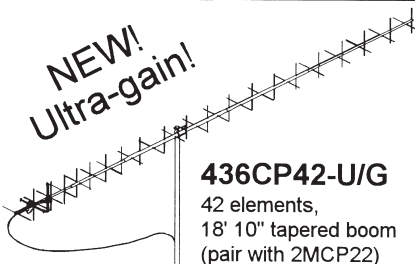
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identify appropriate technologies that could be incorporated into Fox, and develop specifications, these are all issues that require oversight from our senior engineering team. With their total focus on ARISSat-1, we must defer on Fox until ARISSat-1 is shipped to Russia, the team has time to decompress from a very intense workload the past year, and then evaluate what should be next steps for Fox.

In the meantime, there are some interesting areas of development in the CubeSat community that AMSAT will evaluate as part of our project overview. There are new developments that could have a bearing on what AMSAT decides to build from scratch versus buying off the shelf.

We are also looking forward to seeing the results of the engineering work being done by senior engineering students at SUNY-Binghamton on their next generation CubeSat effort that will be presented at Dayton in conjunction with the AMSAT Forum and placed on display at the AMSAT booth.

I am also anxious to see AMSAT develop the appropriate steps for better project management of a satellite project that focuses on doing the research and development work up front, that develops the appropriate documentation, such as a requirements list, and creates a realistic work schedule that will allow us to better manage our projects. Our experience on ARISSat-1 has been painful with a lot of last minute issues and problems. Better project management not only reduces the probability of running into issues late in a project when it is difficult to resolve them, it also reduces development time and overall cost. A well-managed program also allows our volunteers to understand their impact on project schedules and to prioritize the work being done. The success of this approach, however, requires significant up front planning to ensure that the ground work is properly developed, that appropriate peer review is established, and that the project team has an opportunity to consider all facets of the project before the first piece of metal is cut or first circuit board is created. Working the kinks out on paper in advance of doing actual construction will greatly improve the overall product.

AMSAT is fortunate to have Tony Monteiro, AA2TX, as our VP-Engineering as he has extensive experience in managing major engineering projects and understands both the technical and management issues

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- Video recording, digital conversion and editing
- Write technical or instructional material
- Educational activities
- Promoting AMSAT as an Area Coordinator



and any other area you think you think you can make a difference.

We often have people volunteer, but many don't deliver on their promises. So, pick an area that you think needs improvement and explain what you will do to make it better. Then do something to show that you can follow through.

Send your suggestions, actions plans and a description of why you are capable of doing this task to Gould Smith, WA4SXM, wa4sxm@amsat.org

of managing projects as well as how all volunteer groups interact. AMSAT must create the culture that recognizes the importance of proper planning and provide the guidance to help our volunteers succeed in developing successful satellite designs. This is indeed rocket science and we're in the process of developing a new generation of satellite builders within AMSAT. One of the remarkable aspects of ARISSat-1 is that we have indeed attracted key individuals to assist with the project who were not previously involved with our satellite programs.

The ARISSat work will be completed on July 1. If you are interested in working on our Fox project, please contact Tony Monteiro, AA2TX, at aa2tx@amsat.org.

73,

Barry Baines, WD4ASW

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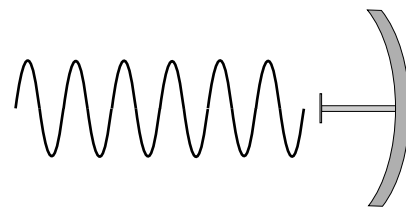
THANK YOU!



Fund Raising Potential

AMSAT participates in the eBay Giving Works through Mission Fish on eBay. It allows anyone selling anything to donate a percentage of the proceeds they receive to AMSAT automatically. All you have to do after entering the starting price and quantity of your item is to make your selection under eBay Giving Works. If you click on 'Or, select another nonprofit you love', you can choose AMSAT. Just enter the percentage of the proceeds you would like to donate from 10-100% and you are ready to go. AMSAT will greatly appreciate your kindness.

Should you have any questions, contact Bruce Paige, KK5DO. kk5do@amsat.org ☎



SKN

CORRECTION

I made a math error in my essay about AO-7, which appeared in the January-February 2010 issue of The AMSAT Journal. I reported that, as of the evening of November 24, 2009, AO-7 had traveled 7.862 trillion km (4.885 trillion miles) since reaching orbit. Stated simply, I had three zeros too many in my numbers. The actual numbers are 7.862 billion km (4.885 billion miles). I reported that AO-7 had covered 0.831 Light Year. The distance actually is about 7.25 light hours.

Sorry for the confusion.

Tim Lilley, N3TL ☎



Doug Loughmiller, W5BL (Ex KO5I, G0SYX) (Left), Keith Pugh, W5IU (Center), and Douglas Quagliana, KA2UPW/5, (Right) demonstrated how to work VO-52 at the Cowtown Hamfest.



Here is a rooftop photo of Craig Bledsoe, KL4E, working Straight Key Night (SKN) on AO-51 on New Year's Eve from his mountainside QTH near Eagle River, Alaska (BP51). The temperature was approximately -10 degrees Fahrenheit at the time. The configuration is a Yaesu VX-5R feeding a Mega-Arrow (amplified and filtered Arrow dual-band Yagi). The key is a surplus Knee Key from a World War II tank radio command set. The downlink was full of signals from all over the lower 48 and Canada. A good time was had by all!

73,
Craig, KL4E

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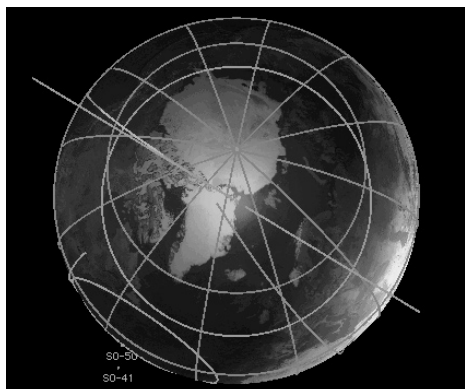
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UoSAT-OSCAR-9 CCD Image Display – 22 Years After Reception

by John A. Magliacane, KD2BD, kd2bd@amsat.org

The UoSAT-OSCAR-9 and UoSAT-OSCAR-11 satellites, along with several early SAREX missions, were extremely influential in igniting my interest in the Amateur Satellite Program. The UoSAT satellites were designed and built by members of the Electronic and Electrical Engineering Department at England's University of Surrey (UoS) under the leadership of Dr. Martin Sweeting, G3YJO. Rather than provide communication services and replicate the function of other OSCAR satellites in orbit at the time, the UoSAT spacecraft carried a host of scientific instruments into low earth orbit, and provided a wealth of engineering and scientific data regarding the near space environment through their beacon transmitters.

Data Formats

OSCAR-9 and OSCAR-11 downlink transmissions generally took the form of 1200 bit per second ASCII data containing 7 data bits, even parity, and one or more stop bits. For the most part, the satellites employed synchronous AFSK modulation on a 145.825 MHz FM carrier, and typically carried real-time and whole orbit telemetry, on-board computer status information, and weekly news bulletins authored by spacecraft controllers at the university. Occasionally, pictures taken by an Earth-pointing Charge Coupled Device (CCD) video camera on-board OSCAR-9 were transmitted by the satellite on its 2 meter downlink. Unlike the typical 7-bit asynchronous ASCII transmissions made by this satellite, CCD image transmissions were made using a 4-bit binary synchronous protocol that was

incompatible with the asynchronous serial ports found on many home computers. As a result, CCD image demodulation, decoding and display operations were complicated by the need for specialized hardware specific for this purpose that was lacking in the majority of simple AFSK demodulators and home computers used for reception of UoSAT ASCII data transmissions.

Combating RFI

Downlink signal levels from the UoSAT satellites were usually sufficient to provide adequate reception using little more than a hand rotated indoor Yagi antenna feeding a low-noise preamplifier and 2 meter FM transceiver. However, the level of radio frequency interference (RFI) generated by a computer operating in close proximity to the receiving antenna was often significant enough to cause harmful interference to satellite reception. A simple work-around to this problem was to time-shift the demodulation process by making audio tape recordings of UoSAT downlink signals with the computer turned off, and then playing the recordings back through the demodulator and computer after the satellite pass had ended. Over time, this practice led to the accumulation of satellite-related recordings that, in my case, resulted in capturing an OSCAR-9 CCD Earth Imaging Camera transmission on one of my earliest recordings.

UO-9 CCD Image Transmission

OSCAR-9's Earth Imaging Camera was designed by Surrey's Dr. Paul Traynar using a very early generation monochrome charge coupled device (GEC MA357) having a resolution of 385 x 288 pixels and a field of view of 60 degrees. In operation, video generated by the camera was digitized to a resolution of 256 x 256 pixels and a depth of 4 bits. The digitized frame was stored in 32 kilobytes of random access memory under the control of the satellite's Video Display Experiment (VDE) module. Once in the VDE, image processing operations could be carried out by the satellite's primary spacecraft computer prior to transmission.

Each digitized pixel captured by the CCD camera was transmitted sequentially in the form of 4-bit words sent MSB first. Using synchronous AFSK at a 1200 bit per second transmission rate, one cycle of a 1200 tone was used to represent each binary '0', and

two cycles of a 2400 tone were used to represent each binary '1'. Unique video line and frame synchronization codes were added during transmission yielding a total of 271360 bits per frame that required just over 226 seconds to receive in its entirety.

High-Performance Data Demodulation

In July 1991, I shared some self-authored UoSAT-OSCAR-11 telemetry decoding software with Richard Langley at the University of New Brunswick. In exchange, Richard provided details of a high performance UoSAT satellite demodulator designed by James Miller, G3RUH, that appeared in the May 1983 issue of *Wireless World* magazine. Unlike the simple demodulators I had been using for UoSAT reception, Miller's circuit was a sophisticated design that employed synchronous detection and correlation decoding circuitry capable of achieving optimum performance under low signal-to-noise ratio conditions.

Several years later, Miller released an updated version of his demodulator. Coined "Mark II", this demodulator was essentially a stripped-down version of his original design that eliminated circuitry capable of demodulating OSCAR-9's 300 baud data transmissions and identifying video line and frame synchronization codes sent during OSCAR-9 CCD image transmissions. Since OSCAR-9 had already decayed in the Earth's atmosphere and ceased operation by this time, these features were no longer relevant. Therefore, I decided to duplicate the "Mark II" version of the demodulator

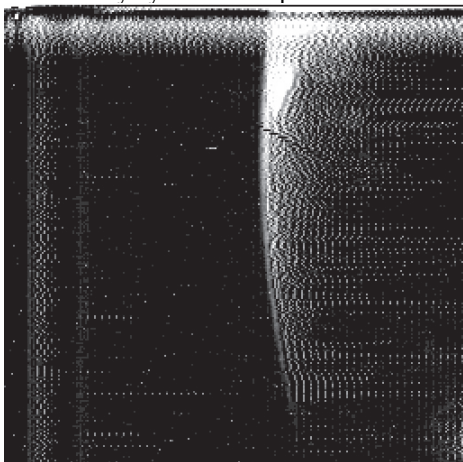


Figure 1: UoSAT-OSCAR-9 CCD camera image taken on Wednesday, September 23, 1987.

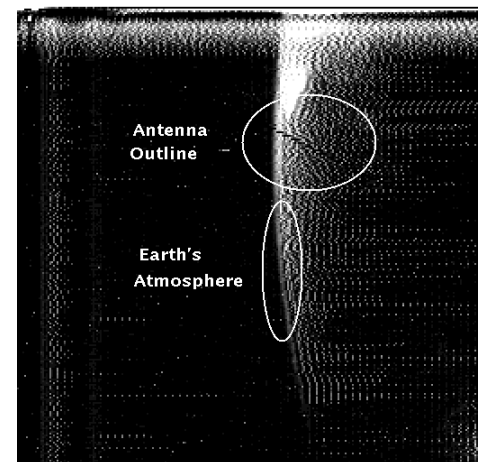


Figure 2: A bright land mass (or cloud), the silhouette of one of the satellite's antennas, and the glow of the Earth's atmosphere are visible upon close inspection of the image.

with the intention of dedicating its use toward OSCAR-11 satellite reception.

Hacking Bits

Sixteen years later on a mission completely unrelated to satellite work, I began development of a NOAA Weather Radio Receiver with Specific Area Message Encoder (SAME) capability. Like OSCAR-9's CCD transmissions, SAME data transmissions are made using an AFSK modulated synchronous protocol. My approach to SAME decoding involved employing a Microchip PIC16F88 microcontroller fed by an AFSK demodulator. Firmware running within the microcontroller was developed to establish synchronization with the incoming data stream when transmission of a SAME preamble sequence occurs. The preamble is merely a unique and recognizable bit pattern (0xAB repeated 16 times) that is transmitted prior to severe weather announcements to facilitate proper synchronization and byte framing operations within the SAME decoder. With an understanding of OSCAR-9's CCD image transmission protocol still fresh in my mind, I immediately recognized many similarities between the OSCAR-9 CCD and NOAA Weather Radio SAME synchronous transmission protocols, and several design concepts leading toward successful CCD image decoding began taking shape in the back of my mind.

Putting the Pieces Together

During the summer of 2009, I came across the audio tape containing my OSCAR-9 CCD image recording. With considerable knowledge and experience gained through various signal processing and digital demodulation projects spanning several decades, and with a computer system vastly superior to the Commodore 64 I had been using to track satellites and decode UoSAT transmissions in the 1980s now at

my disposal, I quickly developed a dogged determination to decode and display the CCD transmission I had captured on tape, once and for all.

I began this process by making a digital copy of the audio recording using my Linux-based computer and soundcard as a recording device. Analysis of the recording using "baudline" spectrum analysis software found the AFSK tones to be slightly high in frequency. This frequency error was probably the result of making the original recording on a low-cost 1970s vintage cassette tape recorder and playing it back through a more modern and higher quality tape deck operating much closer to proper speed. "SoX" audio processing software was used to correct the speed of the recording, and also provide some bandpass filtering around the mark and space audio tones in an effort to maximize the signal-to-noise ratio of the recording.

The conditioned recording was then processed by my G3RUH UoSAT demodulator, with clocking and data signals from the demodulator fed into a PIC16F88 microcontroller running firmware adapted from my earlier weather radio project. Instead of analyzing the received data stream for the presence of a SAME preamble sequence, the microcontroller established synchronization by looking for the occurrence of a valid 32-bit CCD line synchronization code (0x5BA45BA4) that preceded every line of digital video transmitted by the satellite. Once synchronization was established, the microcontroller packed adjacent pairs of 4-bit video samples together into 8-bit bytes. Each packed byte was transferred to my Linux-based PC over a 57.6 kbps RS-232 serial connection, where it was saved to a disk file as a sequence of hexadecimal digits. This data was acted upon by an application I

developed that generated a 256 x 256 x 4 bit portable grey map (.pgm) image file from the raw video data previously captured to disk.

Success!

The entire process worked flawlessly, although the quality of the resulting image was a bit disappointing. I had suspected for many years that the scant few OSCAR-9 CCD images I had seen published in literature during the satellite's heyday had been rendered using a dot dithered grey scale. I was quite surprised to find my image sharing very similar qualities, despite my use of techniques capable of resolving detail and grayscale levels far exceeding those of the original image. Despite the imaging artifacts, close inspection of the photo reveals some interesting details, such as a bright cloud or land mass in the upper left-hand corner of the Earth's limb, the thin glow of the Earth's atmosphere against the darkness of space, and a diagonal silhouette of possibly one of the satellite's VHF/UHF turnstile antennas against the bright Earth below.

With the transmission finally demodulated, its contents finally decoded, and the image finally rendered, I grew curious as to when the image might have been captured by the satellite's camera. Rewinding the tape further, I discovered a recording of an OSCAR-11 transmission made slightly earlier in time that contained telemetry and on-board computer status information dated September 25, 1987. A news bulletin dated the previous day was also contained in the transmission, and carried the following information regarding OSCAR-9:

** UO-9 Operations **

A CCD image was taken by the UO-9 camera on 230987 and transmitted at 1200 bps on 145.825 MHz. CCD transmissions will take place each Wednesday.

Based on this information, I believe the OSCAR-9 image I processed nearly 22 years after reception was most likely taken on September 23, 1987.

It remains to be seen whether additional CCD image recordings await discovery in the recesses of my tape library. However, the most fascinating outcome of this endeavor has been the realization that scientific data collected by amateur satellites can provide on-going technical challenges and opportunities for experimentation and learning, for those so inclined, even decades after the satellite's transmissions were originally made. ☺

```
5B A4 5B A4 40 32 12 00 40 32 30 45 B2 30 55 A2 10 68 00 82 10 07
12 09 09 24 11 94 21 08 60 70 80 A1 20 90 82 40 07 41 0A 30 06 90
08 31 01 82 10 17 22 02 56 05 0A 11 0A 10 09 22 00 49 22 20 14 A2
00 78 10 A3 00 88 21 11 93 31 1C FD BD FF F9 FF F6 DF FF 6B CE EE
4A FF 27 CD AD 57 D7 6C 4B D8 5E A6 09 9D 34 24 72 70 45 C3 32 31
27 80 2A 30 08 A2 00 89 12 42 06 15 0A 12 09 07 12 08 07 22 03 57
5B A4 5B A4 00 11 00 00 00 11 24 20 71 70 A0 70 60 60 50 80 20 10
82 21 05 92 22 01 48 21 10 81 12 40 07 41 09 42 22 01 48 21 11 91
10 41 02 30 04 91 13 40 06 42 07 05 09 13 22 00 48 21 11 81 11 51
11 41 11 42 10 18 13 22 00 59 48 EF D8 FF E8 DF FB 8E FF 4B FF 59
FF 82 BE 46 BE 16 9E 2C 1D CA 56 7C 08 B7 20 59 92 41 19 52 22 02
57 06 07 08 09 14 23 00 48 21 10 91 12 40 08 31 01 81 21 20 60 60
5B A4 5B A4 00 11 80 00 00 11 24 20 70 60 80 A1 10 90 00 10 00 01
12 41 07 30 06 80 07 30 00 91 00 90 10 31 00 81 10 40 00 31 00 70
00 80 00 41 11 41 00 31 00 70 00 90 10 31 00 70 00 90 11 42 00 06
10 09 12 21 02 80 08 31 00 93 46 CF CF EF 9D FF A7 EF B9 DF F7 4B
EE 37 AC 7C B4 95 D7 74 3A C2 8A 68 09 D5 23 30 25 80 61 20 90 81
43 30 03 90 06 30 06 70 03 A0 01 A1 00 91 11 31 00 70 00 91 01 31
```

Table 1: Three sequential lines of OSCAR-9 CCD camera video in hexadecimal format captured by KD2BD, each containing 256 4-bit samples preceded by a 0x5BA45BA4 line sync code.



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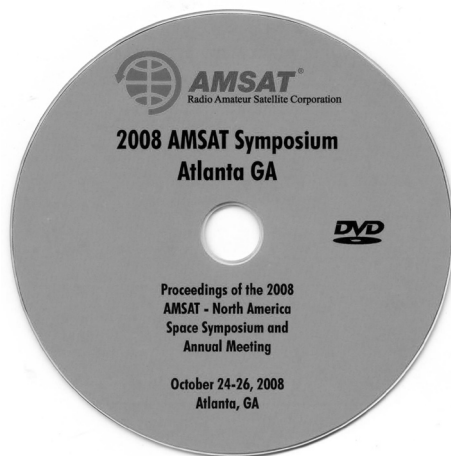
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AMSAT in Cornwall – April 28, 2010

by Maurice-Andre Vigneault, VE3VIG, ve3vig@amsat.org

AMSAT Canada Delegate

ARISS International Working Group

Your AMSAT/ARISS representatives were once again on the road, this time visiting the Cornwall Armoury for the April meeting of the Seaway Valley Amateur Radio Club in Cornwall, Ontario.

We had been invited to speak on satellite communications and we brought along information for the ARISS program as a school in that area had approached us inquiring about a possible contact between students and astronauts. I wanted to inform the local Amateur Radio community on how much fun it can be to participate in such a contact and to encourage them to lend a helping hand.

The structure of the talk was based on the Satellite Communications Training that we provide gratuitously at the Canada Science and Technology Museum's VE3JW Amateur Radio Exhibit in Ottawa.

The talk was well received and enjoyed as some of the participants realized that they already had a satellite station, now that we have easy-sats such as Echo and Hope; a dual band radio and a small gain antenna is all that is necessary. By the way, we are hearing more and more portable stations on the satellites nowadays.

AMSAT/ARISS Working Group representative Darin, VE3OIJ, of the PS&U

Committee, also a VE3JW volunteer, was along to help. The AMSAT banner was predominantly installed and we distributed handouts on AMSAT and the ARISS program, stickers and logos from the Canadian Space Agency and we had two complete mini satellite stations displayed.

Here is the way Joe, VE3ADB felt about our visit.

"Maurice-Andre:

This is to formally thank you and Darin on behalf of the Seaway Valley Amateur Radio Club for coming to talk to us during last evening's General Meeting. Your very informative and technical presentation was the highlight of the evening and was much appreciated by all who came. Not only did you enlighten us on this very interesting topic of Satellite Communications but you had the foresight to provide us with a CD containing the electronic version of your presentation as well other useful software and satellite-related programs. One of our members (VE3OLB) has committed to making copies for all who came. Your presence brought out Joe, VA3JHT, who obviously values your friendship from "the old days". Patricia, VA3PUR, was so happy to hear that we had secured you as our guest speaker that her eyes lit up during the

executive meeting when this was discussed. Her smile last evening further evidenced this as she presented you both with our small tokens of appreciation for your travels and knowledge sharing. Attached is a photo of that evening which we hope will keep the memories of our time together alive. Do come again in the near future.

Again, thanks.

73, Earle, Jim, Patricia, Joe and the rest of the club, SVARC"

An enjoyable one-hour ride in Eastern Ontario from Ottawa made it a convenient one-evening outing and gave us a chance to meet with old acquaintances and make new friends while learning about the different activities of a lively Amateur Radio community south of us.

Thank you to the Seaway Valley Amateur Radio Club and to its President Earle, VE3IMP, for the warm welcome and for the opportunity to entertain them on AMSAT/ARISS activities. We thankfully accepted the nice coffee mugs dressed with the SVARC logo presented to us at the conclusion of the meeting.

Thank you all and we're looking forward to other enjoyable outings in the near future.

Maurice-André Vigneault, VE3VIG 🌐



Maurice-Andre, VE3VIG, Patricia, VA3PUR, SVARC Treasurer and Darin, VE3OIJ



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